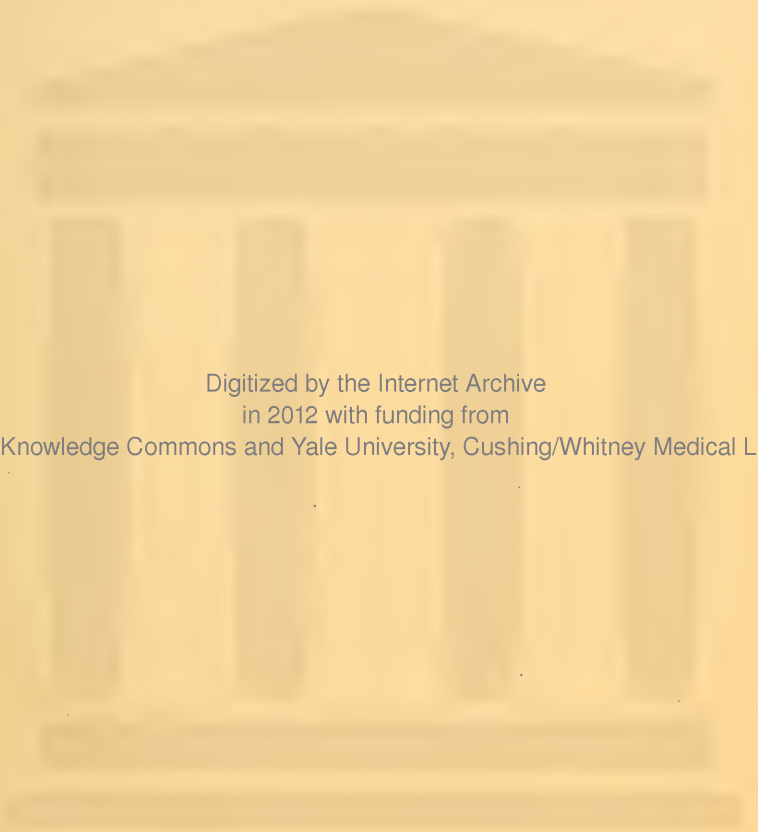
ANIMAL EXPERIMENTATION



ANIMAL EXPERIMENTATION

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A Series of Statements Indicating Its Value to Biological and Medical Science

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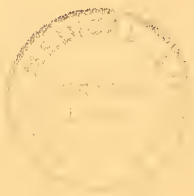

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Introduction

THE following are the statements of various remonstrants to proposed legislation to further restrict experimentation upon animals for medical and biological purposes in the Commonwealth of Massachusetts. They were called out at the legislative hearings upon this subject in the spring of 1901.

The agitation in favor of such further restriction has been carried on for several years, and the views of the remonstrants are nowhere to be found in print. Many of the friends of research have expressed a wish to have some document to which reference may be made for the facts in the case, and it has therefore been decided to publish this book.

It contains, not a shorthand report of what was said at the hearings, but the main points of what was so said, with additions from some who were not heard for lack of time, or because of absence from the country.

The writer has, in each instance, corrected his manuscript immediately before publication.

It is hoped that the statements that follow will be of value in placing the matter of experimentation upon animals, for purposes of teaching and investigation, in a clearer light before those interested in the subject.

HAROLD C. ERNST.

Contents

Animal Experimentation

CHARLES W. ELIOT

PRESIDENT OF HARVARD COLLEGE

(President Eliot was not in the country at the time of the hearings in 1901. The following is the main part of his statement made at the similar hearings in 1900.)

THE question, Why not license vivisectors? has been asked. I want to answer that question. There is no authority competent to examine the licensees. We may examine plumbers or dentists or physicians, and license them, because we can obtain a board competent to pass upon their qualifications; but there is no possibility of determining in that way the qualifications of the rare men who are competent to devote themselves to medical research. There are few such men in Massachusetts, and few in any civilized State. Sitting behind me is such a man, a professor in the Harvard Medical School, who makes all the diphtheria antitoxin supplied in Massachusetts by the State Board of Health. It is the best made in the country. Now there is no one in the United States competent to examine Professor Smith and give him a certificate of qualification for that beneficent work.

Bishop Lawrence has referred to antitoxin; but he did not mention that in Massachusetts the mortality from diphtheria has been reduced from thirty-seven to eleven per cent in hospitals, and below that in private practice. What

a saving of human life! What a saving of human distress! This saving of life, this relief from anxiety and dread, is dependent on the production of the strange agent, antitoxin. In that production it is necessary that horses should be inoculated with toxin of the diphtheria bacillus; and that having passed through a fever they should be kept for periodic bleeding — about once a month — perhaps for years. The serum from their blood is then tested on guinea pigs, all of which suffer and many of which die. Discomfort and pain for the animals used, and death for some of them, are necessary incidents of the manufacture of the diphtheria antitoxin.

The question for your committee is whether it is worth while that animals should so serve the human race. That is the bottom of this question — whether it is right that animals should so serve the human race. I believe it is altogether right. I should go much beyond that simple affirmative, and say that I should not be able to fix a limit to the amount of suffering that animals ought to be subjected to to save one human baby. Would any of us weigh the life of a thousand guinea pigs against the life of one of our children? That is the question for this committee.

Let me call your attention also to the fact that the humanity which would prevent human suffering is a deeper and truer humanity than the humanity which would save pain or death to animals.

The human race does not count the death of an animal at all. We stop animal life without the slightest compunction. Millions of animals that are enjoying life — bullocks, sheep, chickens, fish, oysters — are killed for our tables every year. We do more; we interfere with the natural happiness of animals — all of us, every day. We do not hesitate for a moment to do so. See how we geld male animals; how we deprive the cow of her calf; how we kill

the calf, that we may have the milk intended for it. What infinite liberties we take with animals in depriving them not only of life but of their natural happiness! Our liberties with animals in this way are so prodigious that this particular liberty to which your attention has been so urgently called seems infinitesimal.

The progress which has been recently made in medical research is one of the most extraordinary achievements of the nineteenth century. Such research is absolutely the most humane of human occupations, because it has prevented human suffering and death on a great scale, and because it promises to achieve in the future still greater triumphs over pain and death.

We know what has been done in regard to smallpox and diphtheria, and we have great hope beyond — the hope of being able to deal with meningitis, pneumonia, cancer, yellow fever, consumption, and the plague. These enemies we have not yet learned how to defeat. The study of these problems is the most humane application that can be made of human skill, thought, and imaginative insight.

HENRY P. WALCOTT

ACTING PRESIDENT OF HARVARD COLLEGE
(at the time the hearings were held in 1901).

CAMBRIDGE, March 23, 1901.

DEAR DOCTOR, — I am afraid that I cannot recall anything of the talk I gave the other day, for I was entirely upset by an accident to one of my eyes, which put me in much pain, — and this has not yet left me.

What I meant to say was on these lines:

The University has entire confidence in those of its teachers who have occasion to use vivisection.

It therefore protests against any unnecessary interference with the freedom of teaching.

Interference is not necessary, because the Corporation and Board of Overseers have a numerically small representation of medical men. Out of thirty-seven members, five only are physicians; the rest are lawyers, judges, philanthropists, clergymen, and business men.

No question has ever been raised in these bodies, to my knowledge, upon the subject of vivisection.

The limitation of vivisection to medical men would have shut out Pasteur, a chemist, — the great benefactor of his generation.

Some of the best work of the State Board of Health is founded on the practice, and has been fostered by appropriations of money from the legislature year after year; no objection has ever been made to this work, which includes the production of antitoxin, through men employed by the State and paid by the State.

The laws for the protection of the people from poisoned or adulterated foods are only capable of execution by a body having authority to try experiments — sometimes painful — on animals, instead of allowing dishonest trades to inflict suffering on men, women, and children.

Of course there is much more to say, but others have probably said it better.

Faithfully yours,

H. P. WALCOTT.

G. STANLEY HALL

PRESIDENT OF CLARK UNIVERSITY

PRESIDENT G. STANLEY HALL of Clark University said in substance, that he was not a vivisector or even a physician, but during the eight years as professor at the Johns Hopkins University and since 1889 at Clark, he had followed nearly every experiment involving vivisection in those two universities, his own department — physiological psychology — being closely related. He therefore felt himself in some sense both impartial, and competent to form an opinion. Physiology was based on the study of living, as anatomy was upon dead, organs and tissues. Hence to deprive physiology of the right of vivisection would be to stultify its progress, never so rapid as now, and never so helpful in the amelioration of human suffering and the cure of disease.

He traced the analogy between the difficulties which anatomy had to overcome in procuring bodies for dissection, and declared that the same spirit which of old persecuted the great dissectors and condemned them as criminals, in our day animated the false humanitarianism of the anti-vivisectors. The struggle with the anatomy acts was a long one, but the victory was now so complete that every intelligent person sanctions, and the laws of every enlightened land protect and defend, the right to use unclaimed human bodies in dissecting-rooms, and to use them freely. The speaker had no shadow of doubt or fear but that the outcome of the present struggle of existence for physiology would be no less complete, and hoped its friends would exercise patience and, if it was necessary,

leave their absorbing occupations and come up to the State House every year to wage this cultus warfare against well-meaning but uninstructed sentiment.

The speaker recalled his experience many years ago, while a student of Professor Ludwig at Leipzig, — perhaps the most eminent of modern physiologists, who has trained so many of the leading professors in all lands. A bright and sentimental young nobleman had given addresses full of the same stock quotations and stories as have done duty in the discussion before this committee, and had so aroused the sympathies of the ignorant that Professor Ludwig was insulted and pelted with mud and stones on the street. But as things became better understood, a reaction set in, and the professor was made, I think, the president, or at any rate an officer of the Animal Protection Society of Leipzig, where until his death he did more efficient service than any other member in mitigating the sufferings of lost dogs and cats, preventing cruelty to horses, making roads to sandpits, developing the sentiment among ladies against wearing the heads and wings of birds, etc. The sentiment against vivisection has its stronghold among the English aristocracy, and especially among pampered noblewomen, who have the most humanitarian and tender sympathies but have no knowledge or appreciation of science.

Dr. Hall pleaded for vivisection on behalf of the animals, because by these methods only had the great pests among swine, sheep, cattle, and horses been understood and checked. The motive of the vivisectionists is humanitarian to the core, and the only question is whether man has a right to sacrifice animals for his own good. This problem was practically settled when man began to eat animal food and destroy noxious creatures. To understand the real point at issue, one must in imagination place himself at the critical moment of a grave disease

or operation, and read on the faces of the friends or in the hearts of the physicians themselves the anxious but often unspoken question, whether really everything possible has actually been done in the case; whether we ought not to have known more of removable causes, controlled conditions, or have explored the efficacy of the different cures; and this can only be done by the study of living tissue which prejudice names vivisection. All the traditions and all the arguments and all the educational tendencies towards the development of sympathy for life are not on the side of the petitioners, but upon our side.

E. H. CAPEN

PRESIDENT OF TUFTS COLLEGE

I OPPOSE both of the bills now before this committee on two or three important grounds.

1. The proposition to confine this kind of biological investigation to doctors of medicine only is unwise. Some of the most eminent biologists in the world are not doctors of medicine. They have not had time to study medicine. To exclude them from the privilege of research in their specialty would seriously cripple the laboratories, not only in our colleges, but even in our medical schools.

2. These bills are an interference with the freedom of scientific investigation; and this is just as essential to the efficiency of the professor's work as freedom of speech. The immense progress that has been made in medical science is largely due to this freedom. It is unscientific to assume that we have reached the limit of progress. It is more rational to believe that we have only entered upon a field of investigation which is yet to yield the greatest benefits to the human race.

3. This legislation is unnecessary. The facts of excessive cruelty alleged by the petitioners have not been proved. The experiments in the schools of this Commonwealth which pass under the name of vivisection are humanely conducted and for the benefit of humanity. When I look at the men whose lives have been devoted, through patient and painstaking research, to the mitigation of human suffering, the promotion of human health, and the prolongation of human life, I cannot refrain from

saying that the attempt, though it be only by implication, to class them with assassins and murderers and butchers is, to my mind at least, hysterical. I believe that there is no call for this legislation, and that the interests of biological science can be safely left where they now are.

WILLIAM LAWRENCE

BISHOP OF MASSACHUSETTS

(Bishop Lawrence was not in the country at the time of the hearings in 1901. The following represents what he said at the similar hearings in 1900.)

WE are all here on behalf of humanity, so that I do not think any one on one side can speak of any one on the other as more or less humane.

There is in Massachusetts a profession that is devoted to the best interests of humanity, and that has the confidence of the people. I speak of the medical profession. If we are ill, we send for a physician. If one of our family is suffering from a mortal disease, we send for a physician. If a child is dangerously ill the mother at once sends for her physician. She trusts him with the life of her child. The first point that I want to emphasize is that this matter can be left, with perfect confidence on the part of the community, to a profession that has shown itself worthy of such confidence, — in its attitude toward humanity as well as toward the lower animals.

Now there are, as I understand it, already two restrictions: one is the law against cruelty to animals. If there is a case of cruelty to animals on the part of any citizen, be he doctor or layman, it is possible to take the matter to the courts as provided. There is, however, what seems to me a far greater restriction, — that is, the high standing and high principle of the men in the medical profession. Granted that familiarity with vivisection may have promoted in certain men such a degree of callousness to pain that there may have been instances of wanton cruelty in vivisection, I am sure that the general sentiment of the profession would condemn this, —would check it, — would

stop it. This is an efficient restriction, which should be kept well before us.

I am here as a layman in the matter. I am told that the results of vivisection are of the greatest importance. I *know* of one result, that is of the greatest possible benefit to us all, — I mean antitoxin. In the last two weeks diphtheria has appeared in the household of one of our well-known citizens. Two or three children were taken ill with diphtheria. All the members of the household, seventeen in number, have been treated with antitoxin, and the scourge averted. No one can say what would have happened if there had been no antitoxin. The terror of diphtheria is now passing away.

I understand that anti-vivisection has been agitated largely on account of the research work in vivisection. The question is often asked, — I asked it of myself, — Is it right to encourage vivisection where there is no definite purpose or definite object for that particular experiment ? Discovery comes only by research; and the student never knows where his research will take him. If I am not greatly mistaken, the Bell telephone was discovered by what might be called general research. Mr. Bell was searching for more perfect instruments in his work for deaf mutes, when he discovered the telephone. Scientific research, to be efficient, must be left as free as possible. The humane spirit of the men of science in this country must be trusted, and they are, I am confident, worthy of the trust.

Whatever the restrictions in law, vivisection will go on, but the victims will be men and women. Surgeons must experiment on the bodies of men unless they have had full opportunity to first experiment on the bodies of animals. Through the sacrifice of the lower animals under the humane hand of the men of science the lives of men and woman are saved.

GEORGE HODGES

DEAN, EPISCOPAL THEOLOGICAL SCHOOL, CAMBRIDGE, MASSACHUSETTS

My dear Dr. Ernst, — The two points which I tried to make were that the bill is —

I. Unnecessary.

II. Obstructive.

It is unnecessary on account of the existence of other and sufficient legislation.

It is obstructive:

1. To the student of medicine; because it (1) forbids his attendance as an onlooker at experiments, and (2) it forbids his taking part in experiments to demonstrate known truths. Thus it deprives him of that best aid to knowledge, the aid of actual experience. Medicine taught by book would be like navigation taught by book.

2. To the student of biology; because the bill shuts him out altogether.

In general the point was made that experiments upon living creatures *must* be carried on, — if not with animals, then with our children; also that the bill implies that the professors in our two greatest institutions of learning are not to be trusted.

Faithfully yours,

George Hodges.

JAMES DE NORMANDIE, D.D.

PASTOR, FIRST CHURCH, ROXBURY, MASSACHUSETTS

(Statement presented by him, in writing instead of in person, because of an engagement that prevented his attendance upon the hearing at the time when he had expected to do so.)

WHILE I am in entire agreement with all persons who by law or otherwise would prevent any unnecessary suffering of the lower creatures, the proposed "Act to Regulate the Practice of Vivisection" seems to me strangely to overlook or misunderstand the whole purpose and results of the study of physiology, anatomy, or biology.

In the mysterious realm of life we are far from final truth; there is still more or greater light to break upon scientific research.

In physics we know some things about electricity and chemistry, but of these each succeeding class needs not only the text-book but the experiments of the laboratory, — these are infinitely more important to each succeeding class in biology.

When we think of the indescribable sufferings which war, to-day and always, brings to untold thousands of the higher forms of the brute creation, and generally for no good results, and of the sufferings brought to millions of dumb animals that we may have food, the objections to scientific research seem like straining out the gnat and swallowing the camel.

With every law or effort which tends to increase the humane spirit we have profound sympathy, and while laws can do something to create and deepen this spirit, we con-

stantly see, as in the temperance cause, and the observance of Sunday, how little they can do; how they frequently bring on moral deterioration.

If the friends of anti-vivisection would see that a copy of "Our Dumb Animals" were put in every house, and in the hands of every child in the land, to develop from the earliest years a humane spirit, it would do more good than all the laws upon the subject.

I find many persons who have great interest in matters which touch human welfare, and care little about the brute creation; and many persons who would save animals from suffering, who have no desire to prevent or alleviate the sufferings of human beings.

No body of men will welcome more warmly than scientists every necessary precaution which can be thrown around their experiments, as well as all reasonable publicity to them, and we know that as a body they are quite as humane as any class in the community.

More and more, the scientific method which has been of such vast benefit to our generation is becoming the method of the age, and no undue restrictions should be thrown in the path of its advance.

REVEREND J. T. MAGRATH

CAMBRIDGE

(Abstract of statement made by J. T. Magrath at the "vivisection" hearing before the committee of the legislature, Friday, March 19, 1901.)

He desires to address himself to two or three of the general features of this discussion and then to speak in opposition to one of the most important sections of the proposed bill.

It had been said at the hearing last year (1900) by one of the remonstrants that "it was not a case of humanity, because the representatives of each side in the controversy were equally inspired by humane motives." He was prepared to go a step further this year.

After listening to every word which had been said at the hearings this year, in view of the explanation of methods in use in the laboratories so fully and candidly made by the able men in charge of them, and in view of the multiplied evidence as to the great value to the human race of the results due to animal experimentation, he had come gradually but surely to the conclusion that the balance of humane disposition in reference to the sufferings of the lower animals — and that a heavy balance — is on the side of those who are presenting the *remonstrance* to the proposed legislation.

Again, the question of morality has been raised.

It is no doubt a wide and deep, and in some respects a complicated, question. But while civilized society — Christian society — uses, or permits to be used without protest, the lower animals in many ways involving no little suffer-

ing, without thinking for a moment of their consent — as, for instance, that noble animal, the horse, in war — it seems to him that the last places to be coupled with the question of morality involved in the use of the lower animals, are the physiological and biological laboratories of this Commonwealth.

If it is not immoral for the lower animals to be slaughtered, oftentimes with considerable suffering, for men's food, how can it be considered immoral for some of the lower animals to be subjected, under proper auspices, to the processes of experimentation for the physical or mental well-being of man?

He desires to speak in opposition to that portion of the proposed legislation which would prohibit "demonstrations" before classes in medical schools, even when the operations involved would all be *painless*.

It seemed to him that such "demonstrations" would be of immense value in medical training. To do away with such methods of illustration and to rely upon the text-book or the lecture alone, seemed to be like deliberately turning backward.

No high school, not to speak of colleges or universities, in the Commonwealth, would tolerate for a moment such a retrograde course of procedure in reference to education in physics or chemistry.

He pleaded most earnestly that the legislature should not pass any needless or obstructive laws, and that the progress of science should be in no way impeded.

He believed that the present statutes against cruelty to animals, the enlightened Christian common sense of the community, and the high character of those who direct the experiments, were the best and the sufficient safeguard against all abuses.

In conclusion, he uttered a fervent protest against the base insinuations of a lack of human feeling on the part of

physicians and surgeons, and speaking from his own experience of more than thirty years as a Christian pastor of the noble, unwearied labors and the self-sacrificing devotion of the members of the medical profession, especially of their kindness to the poor and lowly, he said that they reflected the highest honor upon, as their work testified most eloquently to the lofty character of, the medical schools which had sent them forth to minister to suffering humanity.

WILLIAM T. SEDGWICK

PROFESSOR OF BIOLOGY, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, AND FORMERLY BIOLOGIST TO THE STATE BOARD OF HEALTH

THE bill is wrongly named. It is really designed to restrict rather than to regulate, as is shown by line three. (The bill will be found in the closing statement by Dr. Ernst.)

Painful experiments are to be subject to restriction, but not painful operations, such as are employed in agriculture, in gunning, fishing, opening oysters, robbing cows of their calves, etc.

An experiment is not something blundered into or carelessly undertaken, but a careful and painstaking investigation. It is interrogating nature under carefully prearranged conditions. Under this bill such experimentation cannot be done except for the *discovery* of unknown or uncertain phenomena likely to be useful for *human* life or to alleviate *human* suffering. No room is left for teaching; no place for painless vivisection for the benefit of learners and students or for the welfare of animals. All this must cease. Experimental physics, chemistry, mechanics, hydraulics, and even experimental botany may go on, but experimental biology, experiments upon even unconscious animals for teaching purposes, must cease. Against this I earnestly protest, for it is a monstrous interference with the freedom of teaching; a denial of the right to use modern methods in an important department of education.

Against the allegation that physiology may be taught adequately from text-books, I give my personal experience

at Yale and at Johns Hopkins. At the former the teaching in my day by text-books was absolutely unsatisfactory; at the latter, experimentally and with vivisections, it was helpful and most successful.

But even the liberty to *investigate* is restricted. No members of the biological department of the Massachusetts Institute of Technology or of Williams College, for example, could either *teach* or *investigate* concerning animals, in the modern scientific way, if this bill passes, for not one of the staff has a medical degree, such as is required in line twelve (House Bill 856).

Clumsy and insulting restrictions are also set upon the *places* in which vivisection is to be done, when all that is necessary for any honest visitor is to apply to the president, or other principal officer of any institution, to learn where these researches are going on.

As a biologist, the head of a department of biology, and one who has needed to do vivisection in scientific research, in the service of the State Board of Health, and in routine teaching, I protest against the passage of this bill, which would interfere with biological work not only in our universities, colleges, and institutes of technology, but also at the Wood's Hole Marine Biological Laboratory, at the United States Fish Commission, and possibly even with some of the work of our State Fish and Game Commission.

Sections *d* and *e* appear to me to interfere seriously with all bacteriological investigation.

Finally, in answer to the question why, if we have nothing to conceal, we object to this act, we reply that:

1. "Regulating" our work means restriction, interference, registration, inquisition, spying. We might as well have similar "authorized agents" admitted to the operating rooms of our hospitals to see if, in their judgment, etherizing is adequately done.

2. Chiefly, however, because we are already under restrictions, answerable to our superior officers (trustees, etc.), men and women who are among the best and most conscientious in the community. We are also answerable to our students, men and women of mature age, some themselves teachers. Visitors, moreover, honestly seeking the truth, are, and always will be, welcome.

Governor Claflin, who appears to have signed with the petitioners, is, I believe, a trustee of Boston University, and ought therefore to be able to control experimentation in its laboratories.

3. Above all, we object because we honestly believe that there are no abuses in Massachusetts requiring this odious legislation. Who are the experimental biologists at whom this bill is aimed? They are well-known men, of character and reputation, vouched for by men like President Eliot, General Walker, Bishop Lawrence, President Capen, and similar citizens.

I protest that these annual attacks, which are based upon no sound evidence of abuse, or likelihood of abuse, in Massachusetts, are utterly uncalled for, unjust, and ought to cease.

HARRIS HAWTHORNE WILDER

PROFESSOR OF ZOÖLOGY, SMITH COLLEGE,
NORTHAMPTON, MASSACHUSETTS

MY DEAR PROFESSOR SEDGWICK, — I may not be in time with this letter, as other things have intervened. Scientific investigation is handicapped already in America in almost every way by preposterous duties, which attempt to thrust inferior American instruments into our hands, and which have attempted to render more difficult the importation of foreign literature. In short I am at present in such a hopeless condition concerning conditions here, that I feel that signatures of scientists given in protest of the present anti-vivisection bill will do little good. Still I wish most emphatically to oppose the pending bill, and feel that *the ignorant and unscientific* have *no right to attempt to direct scientific experiment either by legislation or in any other way.*

Yours very truly,

HARRIS H. WILDER.

MARY A. WILLCOX

PROFESSOR OF ZOÖLOGY, WELLESLEY COLLEGE,
WELLESLEY, MASSACHUSETTS

My dear Dr. Ernst, — I subjoin a statement of my reasons for objecting to the proposed anti-vivisection bills.

Yours very truly,

M. A. Willcox,
Professor of Zoölogy.

1. *As instructor.* — We give a course of instruction in physiology at Wellesley, in which we include vivisection work for purposes of demonstration. The animals are kept under anesthetics during the entire course of the experiments, and are killed before regaining consciousness. We consider these experiments of the greatest pedagogical value, and object to being obliged to give them up, as we should be if the bill became a law. Students who take this work usually do so with the intention of becoming science teachers or of studying medicine. We have at present eleven students in the department who are intending to study medicine; (this statement I did not make to the committee). The physiology class is a small one, and in view of the especial need for economy which we feel just now, it is, as I wrote you, not offered during the current year, but it must soon be given again.

2. *As scientist.* — My general objection is to anything which fetters the free course of investigation. In my opinion restrictions should be imposed only when they are shown to be absolutely necessary. Evidence does not at

present show that restriction of vivisection in Massachusetts is necessary.

3. *As a citizen.* — I object to anything which threatens the progress of measures whose outcome is in many cases beneficial to the health and sanitary condition of the community.

J. S. KINGSLEY

PROFESSOR OF BIOLOGY, TUFTS COLLEGE,
MASSACHUSETTS

I HAVE been asked to appear, in the name of Tufts College and its Medical School, as an opponent of these bills. I will not take your time in rehearsing all of our objections, since many of these have been stated before and my protest would be merely cumulative; but I would say that I indorse, so far as I recall them, every argument that has been made by the remonstrants. There are, however, a few points in which the bills are fatally defective, to which I would call your special attention, although these points have also been emphasized elsewhere.

In the first place they are objectionable in that they limit investigation to Doctors of Medicine, regardless of the fact that Doctors of Philosophy and Science have had a training at least as thorough as that required for the medical degree, and regardless of the fact that many of our ablest investigators are outside the medical profession. Under its provisions an Agassiz could not carry on his work.

Second, it (No. 856) is objectionable in the fact that all investigations which it permits must have as their distinct object the betterment of human health. It utterly ignores the demands of pure science. One cannot foretell what facts can benefit man. A little more than one hundred years ago an Italian noticed that the legs of a frog, when touched with iron and copper, twitched. Could there, apparently, be any observation more remote from practical interests than this? Could there be one the investigation

of which would seem less likely to advance utilitarian ends? And yet I must remind you that our whole electrical development of to-day is the direct outgrowth of Galvani's observation in 1786.

Third, we object to the imputations this bill puts upon us. We object to having our laboratories subject to registration, like a liquor saloon or a pawnbroker's shop. We object to the insinuation which the passage of either of these bills would place upon our biological faculty. We object to any insinuation that we are not fully competent to discriminate between right and wrong, or that being thus able, we are likely, or even liable, to choose the wrong.

Fourth and lastly, we object to the espionage and surveillance to which these bills would subject us. We would be liable at any moment to invasion by agents of societies, the responsibilities of which are certainly no greater than those of our own trustees.

C. F. HODGE, PH.D.

ASSISTANT PROFESSOR OF PHYSIOLOGY AND NEUROLOGY, CLARK UNIVERSITY, WORCESTER

To the Honorable Committee of Probate and Chancery:

MR. CHAIRMAN AND GENTLEMEN, — Permit me to remonstrate against the passage of House Bills 855 and 856 relating to regulation of vivisection. My protest is against these or any similar bills *in toto* upon the ground that not the slightest reason for such legislation exists in Massachusetts.

Four years ago this same question was before the House Judiciary Committee and was thoroughly discussed. It would seem that if just cause existed for such a law the petitioners would have brought forward sound reasons and specific cases of abuse. In both they failed utterly and the bill was reported adversely. Last year the same thing was gone through with and with the same result. So far as I can learn this was the first appearance of attempted legislation of this kind in Massachusetts, but in New York as early as 1867, Henry Bergh made every effort to obtain the passage of an anti-vivisection law. He was, however, firmly met by the Medical Society of the State of New York; and not only were his various bills completely defeated, but a section was added to the New York law for the prevention of cruelty to animals calculated once for all to protect physiologists from the senseless attacks of agitators. It reads as follows:

> "Nothing in this act contained shall be construed to prohibit or interfere with any properly conducted scientific experiments or investigations, which experiments shall be performed only under the authority of the faculty of some regularly incorporated medical college or university of the State of New York."

The successful passage of the English Act in 1876 caused agitation for similar legislation to spread to all Europe and America. France, Belgium, Holland, Norway, Sweden, Switzerland, Germany, and Italy, all promptly reversed England's decision, and, among the States, New York reaffirmed its former action in 1880, 1881, 1882, and 1883, and a similar bill failed to pass in Pennsylvania in 1885.

The action of Germany is particularly instructive in this connection. In 1880 and again in 1881 mammoth petitions were presented to the Reichstag for the passage of a law similar to the English Act. The German Minister of Education made a thorough investigation of the subject and sent letters of inquiry to all the medical faculties of the Empire. Without a single exception these faculties returned the answer that vivisection both as a method of demonstration and of research was absolutely indispensable to their work and strongly opposed legislative interference. On the other hand the movement for the protection of animals from cruelty had grown enormously in Germany. One hundred and forty societies had sprung up, with a membership of sixty thousand. Five of these, numbering about two thousand, had taken a decided stand against vivisection and two had been organized expressly for its abolition. But in 1883, when sixty societies (Thierschutzvereine) sent representatives to the Congress at Wiesbaden, and the subject of vivisection was called for discussion, not a voice was raised against it.

This bit of history is of present importance as illustrating what Dr. Hall has said with reference to the

passing of the present phase of opposition to physiology. The older science of anatomy was obliged to run the same gauntlet of popular misunderstanding and prejudice in the early part of the last century, when its students were compelled to resort, indirectly, to grave-robbing to obtain material for dissection. Massachusetts holds the proud distinction of first legally acknowledging the value of this science by passage of the Anatomy Act of 1831. And in England, not until Burk had murdered in less than a year sixteen persons to sell their bodies, was the Warberton Bill for Regulating Schools of Anatomy passed in 1832.

The discovery of truth and the progress of science is something that no human legislation can stop. It is, on the other hand, the one thing that all intelligent legislators should seek to favor and foster in every possible way. And this brings us to the point that I wish especially to make; viz., the value and importance of physiological science.

In attendance on a number of hearings for the petitioners I have heard a great deal about the sufferings of animals, most of the cases being taken from foreign countries and from the earlier part of the past century, and not a word about the sufferings of human kind. On page 24 of my paper, The Vivisection Question, I give carefully gathered statistics of the number of animals used in Massachusetts during the year 1894–95 in all the institutions of the State in which I could find that vivisection was practised. I have not had the time, nor have I thought it worth while, to collect similar statistics for the year 1899. The result would be about the same. Compare with the number of animals used, most of them painlessly (809, aside from frogs), the 34,419 human beings who die annually of disease. (I do not include in this number deaths from old age or accident.) How many of these are painless? And we must add to this number at least four times as many cases of non-fatal disease; 137,676 cases of sick-

ness with all their attendant suffering, distress, anxiety, nursing, sleepless nights. What shall we say to this?

I come to you from an institution (Clark University) devoted solely to the development of pure science, and my department is that of physiology and neurology. Since we have no medical faculty and do not give medical degrees, my laboratory is thus one that would be absolutely closed, either for instruction or for research, should this bill become a law.

Now what are the values of pure science to the community? I shall mention only one. The science of physiology supplies the great foundation for all rational medicine. Why do we have all this disease and premature death? Mainly because we have not yet learned enough physiology. I speak of the science in its widest sense. We do not know enough of the laws of life. We have not studied sufficiently the causes of disease. Our medical friends, as a rule, have their hands full trying to cure disease; but an eminent medical authority has himself frankly confessed that the doctor is like a blind man striking about him with a club, about as likely to hit his patient as the disease. This state of things will go on, with our 170,000 odd cases of disease and premature death in Massachusetts, until we learn more about the laws of life and improve the quality of our education.

Further, on the side of the physiology of the nervous system, we have in Massachusetts nearly 10,000 insane patients in the various asylums of the State, and the number is annually increasing. Why is this? Largely because we do not know enough about the physiology of the brain. This is not simply a matter of medicine and medical education. Nerve hygiene and physiology touches intimately the education of every child in our public schools and underlies every-day life at a great many points.

My work in Clark University has consisted largely in the

instruction of teachers and in research in the field of nerve physiology. I will not detain you to describe how important experiments on living animals are for demonstrations to classes, — that point has been dealt with; but I wish in passing to add that I should simply stop teaching if I were to be confined to book methods, which this bill would make necessary. No book, lecture, chart, or description can tell or give any adequate idea of complicated processes in physiology; and in endeavoring to produce research men, as I do, men who may become themselves independent investigators, it is absolutely essential that they see experiments as they are in nature.

On the side of investigation, I have been working mainly upon the nerve cell, the changes in it due to fatigue, to sleep, the influence upon it of alcohol and other drugs. An extended series of experiments has also been made upon the influence of alcohol upon the growth of animals and upon their activities and upon the vigor of their offspring. This latter work has been carried on at Clark University for the Committee of Fifty, organized for the investigation of the alcohol problem. Results of these researches have been published in medical, scientific, and, to some extent, in popular journals.

The question is, Mr. Chairman and Gentlemen, would you vote to close a laboratory of this character?

But, as I stated at the outset, my remonstrance is not directed against any particular clause or section, but rather against the bill *in toto*. Every attempt at legislation of this character has endeavored to affix the stigma of "human degeneracy," of criminality upon leaders and workers in science. While bald assertions have been brought forward by the petitioners to this effect, they have not shown the slightest ground for such statements in a single case. The spirit back of this whole agitation is an insult and an outrage to scientific men. That is what I object to. With no

crime or fault, with nothing to conceal or to be ashamed of, and with no reasonable ground of suspicion of anything of the sort, we and our work must be placed under espionage, under the surveillance of the police. This is a reversion to the methods of the Spanish Inquisition, done away with, even in Spain, about the beginning of the nineteenth century.

From active experience in a number of laboratories both in this country and abroad, extending now over more than fifteen years, I can truthfully say that I have not seen a single case of abuse. I have uniformly found anesthetics efficiently and humanely employed. A single instance will serve to demonstrate to you the spirit which, I believe, rules every physiological laboratory in this country. It was in the Johns Hopkins University laboratory. The class in physiology were working upon the reflex functions of the spinal cord in the frog. Our specific directions said: "Etherize the animal and, while under ether, sever the spinal cord at the base of the skull. Then destroy the brain, etc." In passing from table to table Dr. Howell, who was then, and is still, in charge of the laboratory, noticed a movement of the eye of one of the frogs and stopped to ask the man who was working with it: "Mr. ——, did you destroy that frog's brain?" He answered: "I practically cut his head off." "Your directions tell you to destroy the brain." "In such a cold-blooded animal, it is possible that the severed brain may feel pain for some time after the head is cut off. You will break up the brain, please; in all cases where there is any doubt that the animal may be suffering needless pain, we must always give the animal the benefit of the doubt."

J. P. SUTHERLAND

DEAN, AND PROFESSOR OF ANATOMY, BOSTON UNIVERSITY SCHOOL OF MEDICINE

My chief objections to Bill 856 (the one under discussion) are: Section 1, subhead *b* excludes from the possibility of obtaining knowledge by vivisection a large class of scientists who are devoting their lives to the study of biology. In the State of Massachusetts there are a large number of men and women who have devoted years to obtaining a degree,—Ph.D.,—and who are devoting their lives to the study and teaching of biology. Some of these teachers are connected with medical schools, and many, or most of them, have to do with the preparation of students for medical schools. In consideration of the fact that biology to-day is a more comprehensive science than medicine, and that biologists are continually adding matter of great importance to the total sum of human knowledge, I claim that this bill, if enacted, would be a great injustice.

Subhead *c* if enacted would exclude from physiological laboratories the very people for whom such laboratories exist; viz, medical students and biologists. This would be a very severe blow to medical education. The trend of modern educational methods is away from the theoretical and toward the practical. The didactic lecture course is no longer considered a sufficient form of instruction in any branch of science. Technical schools are multiplying, and schools for manual training are being established all over the land. Dispensaries, anatomical and surgical amphitheatres, are considered essential in the educa-

tion of medical students. The object of medical education to-day is to make students practical instead of theoretical; and if they were excluded from the physiological laboratories they would become theorists, and have no working or useful knowledge concerning physiological matters.

Subhead *d* calls for a general anesthesia where frequently a local anesthesia would be quite enough.

Subhead *e* requires the death of the animal at the end of an experiment, before coming out of the anesthetized state. This is a wholly unnecessary provision, and one that would frequently make the experiment worthless, since the very point of some experiments is established by the safe and happy recovery of the animal.

Section 2 is as objectionable in its bearing, and would be as detrimental to medical education along bacteriological lines as section 1, subhead *c*, would be along purely physiological lines, and is to be met with the same serious objections.

Section 3. The objection to this section is that people who have had no technical training, who are generally unacquainted with laboratory methods, who have but little sympathy with the experimental method of education, and who are in avowed antipathy to physiological investigation of any sort, are not fit people to make inspection of physiological laboratories.

Quite apart from Bill 856 (the one under discussion), I would earnestly urge the validity of our existing laws against cruelty to animals. In my opinion the petitioners would do well to bring their charges of cruelty against an institution or an individual before a court of justice and prove whether or not our present laws are insufficient, before agitating themselves and the community concerning the enactment of new laws. In my experience of a quarter of a century of medical life no such test case has come to my knowledge.

ARTHUR W. WEYSSE

PROFESSOR OF PHYSIOLOGY, BOSTON UNIVERSITY SCHOOL OF MEDICINE

My dear Dr. Ernst, — Your favor of the 22d inst. received. In brief, my statement to the committee on the anti-vivisection bills was as follows. I objected to the bills because they were unnecessary, — first, since I regarded the present laws sufficient; and second, because, as others had shown, and as I showed for the Boston University School of Medicine, no such practices of cruelty to animals existed as the petitioners alleged. I further objected to the bills as a scientist, because they would hamper the investigator by needless restrictions, so as to make most investigations on living animals impossible.

Very truly yours,

Arthur W. Weysse, Ph.D.

T. M. STRONG

SECRETARY MASSACHUSETTS SURGICAL AND GYNECOLOGICAL SOCIETY

Summary of Statement

DEAR DR. ERNST, — I advanced nothing in the way of arguments, as they had been presented, and were later, in a much more forcible way than I could express them. I wanted to impress upon the committee that I represented a very large proportion of a school of medicine which was opposed to these bills from start to finish, and that the statements heard in the petitioners' appeal were those of hardly a respectable minority. I could not give to Mr. French (attorney for the bills) other action than that the bill had been mentioned among others. I can now give you quotations from the published minutes of the secretary:

"Dr. Edwin B. Harvey, M.D., Secretary of the State Board of Registration in Medicine, called the attention of the society to several matters just introduced at the General Court. . . . The bill pertaining to anti-vivisection, if passed, will prevent medical schools making experiments with animal life unless an agent of the M. S. P. C. is present. It is the old matter which was rehearsed and defeated at the State House a few years ago.

"These several matters were referred to the Standing Committee on Legislation with full power."

Ex officio, as president, I presented the action of the society as shown in the unanimous action of the committee as against the bill.

The Committee on Legislation of the Massachusetts Homeopathic Medical Society is unanimous in taking the above stand, and so far as a standing committee may voice the sentiments of the majority until repudiated, the State society stands where the city society does. This statement I make as secretary of the combined committees on medical legislation.

The assertion that the majority of my school stands where I say it does I want to make as positive as any statement can be, unsupported by an actual poll of the whole membership. My closing words were an appeal not to take a backward step.

Fraternally,

T. M. STRONG.

JOHN COLLINS WARREN

PROFESSOR OF SURGERY, HARVARD MEDICAL SCHOOL,
SURGEON, MASSACHUSETTS GENERAL HOSPITAL

DR. J. C. WARREN said that vivisection had been an important factor in the wonderful changes that have taken place in surgery during his professional career. When he began practice in 1869 there was a frightful amount of hospital disease in the surgical wards due to the infection of wounds. Twenty-five years before, anesthesia had been discovered, and this had given a sudden impetus to surgery for which science was not prepared. There was in consequence a greater amount of hospital gangrene, erysipelas, and pyemia than there had ever been before in civil practice.

Pasteur's researches gave Lister the hint as to how to combat this. Lister's first attempts in the antiseptic treatment of wounds were very crude, and it was only after years of careful investigation of the traumatic infective diseases by experimental research with animals that the system was perfected and these diseases banished from our hospitals.

Dr. Warren said that he used experiments on animals to some extent in teaching. It was necessary, for instance, to show the students the nature of a gunshot wound of the abdomen and the chest, otherwise they would be unable properly to appreciate the principles of treatment of those conditions. To be competent to find and sew up a wound of the intestines it was necessary for the student to have such personal experience.

Mr. French (counsel for the petitioners) asked Dr. Warren if Drs. Bigelow and Tait were not strong anti-vivisectionists. He did not reply to this, but he thinks it ought to be pointed out that Dr. Bigelow obtained his knowledge of vivisection sixty years ago in another country, and that Mr. Tait never accepted the teachings of Lister.

ARTHUR T. CABOT

SURGEON, MASSACHUSETTS GENERAL HOSPITAL

DEAR DR. ERNST, — My statement before the committee was, as nearly as I can remember, substantially this:

The recent very great advance in surgery has received most important aid from animal experimentation. The operations on internal organs now possible necessitate, for their safe performance, a very exact knowledge of how these vital organs behave under different conditions of trauma, and this knowledge can only be properly gained by testing various proposed operative measures on animals before trying them on human beings.

I believe that surgery is on the threshold of great advances, which again need experiments on animals to go forward, and I deprecate, therefore, any legislation which could in any way interfere with these experiments, which are important not only for the treatment of the human race, but also for the treatment of sick and ailing animals.

From what I have known of the methods of experimentation followed, no undue or unnecessary suffering is inflicted. The very nature of the operation, and the necessity for having the animal quiet during operation, makes anesthesia most important, and it is, as far as I know, universally employed. Here ends my personal statement.

In answer to cross-examination, I said that Mr. Tait, whose statements seem to be of so much importance to the petitioners, was a man of wild statements. He had said at one time "that if he could get enough disease

germs, and they were dry and elastic, he would be glad to use them as a dressing for his wounds."

I said also, in regard to Dr. Bigelow, the other eminent surgeon depended upon by the petitioners, "that with all my association with him during the last years of his life, I never heard him say a word against animal experimentation."

Another fact about Lawson Tait that I did not mention is that he refused his patients morphia after his operations, even at the expense of great pain.

Very truly yours,

ARTHUR T. CABOT, M.D.

MAURICE H. RICHARDSON, M.D.

SURGEON, MASSACHUSETTS GENERAL HOSPITAL

DEAR DR. ERNST, — The points which I endeavored to cover in my testimony before the legislative committee are as follows:

I. The present laws permit a wise freedom of investigation in the hands of those best qualified to make such investigation — men who are truly and deeply humane, who would hesitate long before inflicting the slightest pain were it not that in the end humanity is the gainer.

II. It permits renewed investigations in the hands of physiologists and students — investigations of which the surgeons are quick to take advantage in the cause of humanity.

The physiological investigations especially desirable for the advancement of surgery are:

(1) Experiments upon the brain and spinal cord, by which the injuries and diseases of these organs may be clearly recognized and exactly located, so that the surgeon may unhesitatingly and unerringly apply his remedy to the part affected. Without animal experimentation, surgeons must for years blindly inflict upon suffering human beings operations unscientific in conception and uncertain in effect, just as they were obliged to do, for example, in the operation for the control of cerebral hemorrhage before the experiments upon monkeys enabled them to tell just where the bleeding is going on, and just how it can be stopped.

(2) Experiments upon the thoracic organs — the heart, the lungs, the esophagus, and the bony walls of the thorax — to determine the possibility of operating directly upon these structures without causing death.

A few of the possible truths which, for the promotion of thoracic surgery, we wish demonstrated upon the lower animals are:

(*a*) The feasibility of removing a portion of diseased lung — how much lung can be sacrificed without causing the death of a dog, in order, for example, that we may remove the focus of a tubercular lung from a human being.

(*b*) The possibility of exposing the bronchial tubes for the purpose of removing foreign bodies accidentally inhaled, after the failure of the ordinary methods through the mouth and trachea.

(*c*) The possibility of operating directly upon the heart in stabs, in gunshot wounds, and in disease — the extent to which we can expose the heart for exploration of possible lesions without causing the death of the patient from the exploration alone.

(*d*) The possibility of operating upon the thoracic portion of the esophagus through the back. I have been asked recently to operate upon an esophageal diverticulum situated near the stomach. Anatomically the operation is possible upon the human being, but I do not believe that it can be successfully performed upon the living mammal. Shall we try it first upon the patient or upon the dog?

(*e*) The extent to which thoracic explorations can be carried without too great immediate danger. How far can I follow, for example, a tumor of the neck pressing upon the lung; how much of the thoracic wall am I justified in removing in malignant disease of that wall? Shall I sit idly by and see a patient bleed to death from a wound of the heart, lung, or thoracic blood-vessels, or shall I

ask the physiologist to tell me whether I can cut down upon the bleeding vessel and secure it without causing the patient's death from the operation itself? Will the remedy be more dangerous than the disease?

(*f*) The possibility of repairing damaged arteries and veins, the tying of which would necessarily be fatal. A wound in the innominate vein, for example, closed by tying that vein, would be probably fatal; closed without stopping the circulation through it, the patient would live. Many experimental investigations are necessary to determine the possibility and advisability of suturing these arteries and veins, the ligation of which would cause death of the parts affected.

(3) Experiments upon the abdominal organs.

Although so much has been accomplished already in abdominal surgery, thanks to the quick application which surgeons have made of the truths of physiological demonstration, much remains to be learned. We wish to know, among a great variety of things:

(*a*) How to divert the blood stream around the liver in cases of obstruction to the portal vein. Is a direct communication between the main portal trunk and the inferior vena cava a feasible operation? I, for one, should say that the surgeon who tries it first on the human being will cause the death of his patient. Experiments upon animals will demonstrate whether this conception is absurd or not. To perform such an operation upon human beings would, however, be no more regardless of human life than to forbid the demonstration of its feasibility upon the lower animals.

(*b*) How much of the digestive tract can be removed from a mammal without permanent and hopeless impairment of the digestive function.

(*c*) What and how much can be done to the urinary tract in the extirpation of disease? What is the course

and effect of the tubercle bacillus in tuberculosis of the genito-urinary passages, and how can such infections be prevented or overcome? (The single subject of the experimental study of tuberculosis in general justifies an army of workers in the field of experimental pathology.)

(*d*) The physiological functions of the spleen, and the influence of the spleen upon the blood; of the blood upon the spleen. The possibilities of health after removal of the spleen — all these questions demand the aid of the physiologist.

(*e*) Finally, although there are many other questions, I may mention the possibilities in the surgery of the pancreas. In the acute diseases of the pancreas there is at present practically no hope from medical or from surgical treatment. Acute hemorrhagic pancreatitis, for example, is almost invariably fatal. Animal experimentation has shown how this disease may be artificially produced. May it not show also how in its inception it may be artificially cured?

A vast number of similar questions are coming up every day. All branches of medicine and surgery are eagerly working for their solution.

III. Unless demonstrations of operative possibility and of surgical technique are permitted upon the lower animals, the surgeon's only way to gain such knowledge must of necessity be through observations upon living human beings.

IV. Surgeons should practise the great operations of abdominal, thoracic, brain, and spinal surgery upon animals before trying these operations upon human beings. Operations upon the dead are of some value, but they are performed under conditions totally unlike those upon the living. Moreover, no idea can be gained as to the successful or unsuccessful performance of the operation. The step most essential to the success of the operation may have

been omitted, or it may have been badly executed. Such errors of omission or commission can be demonstrated only upon the living.

V. Pain is rarely complained of, even after the severest operations upon human beings, if things are progressing favorably. The vast majority of operations cause in themselves no pain after full recovery from the anesthetic. The suffering is almost wholly mental, and is owing to anxiety and to fear.

In the lower animals the mental element in suffering is, of course, absent.

Very sincerely yours,

MAURICE H. RICHARDSON.

JAMES J. PUTNAM

PROFESSOR OF NEUROLOGY, HARVARD MEDICAL SCHOOL

As a practitioner of medicine and a teacher in the medical school, I object to these bills for the same reason that the petitioners advocate them, namely, in the interests of the relief of suffering. I believe that if either of them should become a law the progress of medical discovery would be impeded and the standards of medical education lowered. Progress in medicine is not possible without some suffering. The only question is, How may the best results be secured at the least cost of suffering? The suffering which practising physicians see is of a character and intensity which is almost unknown to the animal kingdom. Physical pain is the smallest part of it, the much greater part being the anxiety, overwhelming sorrow, and the various troubles incidental to sickness. For the relief of this sort of suffering no conceivable medical education is too good, and the second-rate doctor is the cause of infinitely more pain than the physiologist.

It is often felt that medicine is a finished art and science. But this is not the case. The medical practice of the present day is not far removed from the superstitions of more primitive times and it is under a constant tendency to relapse. It is only by strenuous effort that men can be trained as first-rate physicians. The standards of the Harvard Medical School have been constantly advanced, until now only students from the most intelligent class of the community are admitted. But in order that such students should be attracted, they must be given the opportunity to meet instructors of the best scientific training and instincts,

and we cannot keep such instructors if we hamper them in their teaching and their researches. In such case they will go elsewhere, and medical progress in this community will be blocked.

It seems reasonable to demand that "unnecessary experiments" should be avoided; but the decision as to what is unnecessary must, in the end, be left to the judgment of the men who have such work in charge, even at the risk that they may sometimes err. Let any one go into a laboratory of chemistry or physics and he will see how many thousands of experiments, apparently aimless and useless, have to be made before some great discovery (as the telephone or the X ray) results, though the final experiment that led to this discovery may seem simple enough when once it has been done. I agree with the petitioners that restrictions against cruelty are necessary, but I believe that no restrictions could be devised equal in importance to those already provided by having the physiologists and experimental pathologists chosen from among men of the best training, traditions, and character that the community affords. Public opinion and a sense of humanity are stronger deterrents than the law.

In answer to a question from Mr. French (counsel for the petitioners) as to whether a man might not be a first-rate physician or surgeon without having been himself an experimenter in physiology, I said that I thought such a man might be a *good* physician or surgeon but not the *best*. In illustration I cited the case of Mr. Horsley, of London, an exceedingly able physiologist as well as perhaps the first surgeon of England in his line (surgery of the nervous system), whose practical success has been in part a direct outcome of his experimental work. The limited amount of experimentation done by myself in my early days greatly contributed to my own interest and zeal in the study of neurology.

It is true that a number of excellent men believe that experiments with animals have not contributed much to medical progress, but as regards this point two facts should be considered:

1. There is no subject on which opinions are uniform. Most of us believe that vaccination is useful and should be made compulsory, but there is a society in England containing men like Herbert Spencer and Alfred Wallace who think that vaccination is useless and should not be enforced.

2. The discoveries of physiologists do not always stand out in an isolated form so that their value can be set clearly over against that of clinical observation. On the contrary, these two methods of investigation are so closely interwoven that any one who chooses to say that the advance at any given point was all due to clinical observation, may easily persuade himself, with the aid of a little prejudice, that he is right. Thus, Mr. French has asked whether the discovery of the functions of the thyroid was not due to clinical observation. This is true, indeed, of the *first discovery*, but it is by no means true as applied to our present knowledge of the thyroid functions.

Finally, it is worthy of note that where experiments with animals cannot be made it is more likely that experiments upon human beings will be undertaken. If the chemists who had long known that the inhalation of ether would cause insensibility had determined by careful experiments with different classes of animals the character of this insensibility and the limits of the danger involved, the world would have had the boon of surgical anesthesia some years earlier, and the risks attending the first trials with human subjects would have been avoided.

GEORGE L. WALTON

INSTRUCTOR IN NEUROLOGY, HARVARD MEDICAL SCHOOL

(Written after delivery at the hearing.)

Mr. Chairman and Gentlemen of the Committee:

An experiment made by me when a student has been mentioned by the petitioners, in exactly what terms I do not know, but it seems fair to place the facts before you, and the conclusions which were drawn from that experiment. This happens to belong to the class of experiments to which beneficial results to man can be directly traced, and compared with the degree of suffering which the animals underwent.

At the time of this experiment, I think 1878, the epiglottis, a valve-like organ, placed at the entrance of the larynx, was regarded as absolutely essential to swallowing. This had been doubted by one physiologist (Magendie), who had removed it from animals without their choking. Another physiologist (Longet) had repeated the experiment, however, and found that the animals choked, from which he drew the conclusion that Magendie's experiments had been faulty. This seemed a sufficiently important matter to establish, if possible, beyond a doubt.

Under Dr. Bowditch's direction, and in his laboratory, I performed, therefore, a series of experiments with this end in view. The epiglottis was removed from a number of cats and dogs, the depth of the cut varying in different cases. It was found that no choking occurred (with the exception of a slight cough on one occasion in one of the

dogs, and coughing for one day only in another dog), until in one dog (Experiment VII) the lips of the glottis were removed as well as the epiglottis. This dog coughed always after eating, though after the fourth day he could take many successive swallows without choking. As soon as this fact was definitely established the dog was killed, as were all the other animals experimented on. All were so deeply under the influence of ether at the time of the operation that they could feel nothing. (Three other experiments, made later, established the fact that the epiglottis was necessary in case the glottis itself was defective; that is, that the removal of part of the glottis, leaving the epiglottis intact, did not impair swallowing, while removing the same parts and also the epiglottis caused choking in two dogs. This made, in all, ten experiments in which three choked quite constantly. Experiment number nine, alluded to by the counsel, was one of the last three, not number seven, to which I supposed he alluded.) These experiments established the fact that the epiglottis could be removed for disease if the cut was not made sufficiently deep to include the lips of the glottis, and in case the glottis itself was intact.

With a view to ascertaining if the saving of life could be directly traced to this knowledge, in the establishment of which my experiment was one of the essential factors, I have recently asked one of the physicians in the throat department of The Massachusetts General Hospital whether he could assure me that *as the result of this knowledge the epiglottis had been removed in specific instances for otherwise incurable and progressive disease;* he assured me that such was the fact, and mentioned tuberculosis as the disease.

This, then, is an illustration of the class of experiments in which one can say that the experiment was directly applicable to the saving of human life. In the majority of instances the influence, though quite as essential, is more

indirect. In my own specialty, that of neurology, we rely at every step upon the knowledge of the physiology of the nervous system, a knowledge established largely by animal experimentation, though we can only exceptionally point out the individual experiment upon which we rely for the knowledge we bring to bear on a particular case.

As familiar illustrations of both varieties of experimentation in every-day affairs I may cite the fact that the engineer, on the one hand, can point to the observation of the steam raising the teakettle lid as the starting point for the establishment of the steam engine, while on the other hand, if we inquire upon what experiment the invention of the telephone depends, no one can answer us, though every one knows that innumerable laboratory experiments had to be performed in many directions before the facts were accumulated, the assembling of which resulted in this useful invention.

It may be asked, In what way would this bill prevent such experiments as those upon the epiglottis? The answer is that (1) they were not done by one possessing the medical degree, but by a student, and (2) that the animals had to be kept alive after coming out of the ether in order to determine the effect upon their swallowing under otherwise normal conditions. The same restriction would prevent such valuable and useful experiments as those of Ferrier on the brains of monkeys, for it is essential in such experiments that the monkey come out of the ether before it can be determined just what symptoms follow certain losses of brain substance. The knowledge gained by such experiments is of constant use to the neurologist who is consulted as to the nature and seat of brain disease, and the possibility of operation for its relief.

A word as to the animus of these experiments on animals. It has been at least implied in certain quarters

that they are done for amusement. I think I can satisfy the committee that this was not my motive, by citing an experiment performed on myself about the same time in connection with the study of fever. To satisfy myself upon certain points in the production of fever I remained for a considerable time in a bath sufficiently hot to produce high fever (103.5° F.); the headache, restlessness, and general discomfort incident to this condition (103.5°F.) accompanied the experiment, and the prostration following was extreme.

GEORGE L. WALTON.

HORACE D. ARNOLD

PROFESSOR OF CLINICAL MEDICINE, TUFTS COLLEGE MEDICAL SCHOOL

DEAR DR. ERNST, — The following is a brief outline of my remarks before the Committee on Probate and Chancery:

As a physician in active practice I wished to testify to the great practical importance of the investigations carried on by the laboratory workers.

In considering the proposed bill, it seemed fair to consider the term "vivisection" as employed by the petitioners as practically the equivalent of "animal experimentation" as used by the medical profession. My objection to the bill was, chiefly, that it would seriously hamper such "animal experimentation."

What has "animal experimentation" accomplished for humanity? Diphtheria was taken as an illustration, not because it was the only instance, but because it would be more easily understood by the non-medical mind.

In connection with diphtheria, "animal experimentation" has accomplished the following results:

1. A better understanding of the disease, and consequently greater ability to treat it successfully.

2. Since diphtheria is a type of the infectious diseases, we thus get a better understanding of infectious diseases in general.

3. It has given us a little insight already into the problem of immunity — or that condition which protects the individual from an infectious disease. We confidently expect that "animal experimentation" will in the future solve this problem of immunity and thereby furnish the

means to successfully protect the community — a great advance in practical medicine.

4. It has given in the antitoxic diphtheria serum a most reliable means of preventing and of curing the disease, enabling us to prevent suffering and to save many valuable lives.

From an experience of three years ('89–'92) in the diphtheria ward of the Boston City Hospital, I was able to portray the horrible suffering of the children afflicted with the disease before the days of antitoxin. The mortality in the ward was forty-five per cent. Under the use of antitoxin the mortality has been reduced to nine per cent, and the cases of suffering are rare.

I cited the case of my own child, who had diphtheria in malignant form, and who was saved by antitoxin when all other measures would have been fruitless. No father whose child had been saved by such means would care how many lives of animals had been sacrificed in the discovery. We cannot use the rabbit as a unit in estimating the value of our children's lives!

The section of the bill which requires the animals to be killed immediately, while still under the influence of the anesthetic, would prevent us from proving that new surgical procedures which we *think* would help to save life can be safely tried on living tissues. Where we now first test these measures on the living tissues of animals, we should have to try such measures first on human beings, without any further proof of their efficacy than our *opinion* that they would be beneficial. To this extent this section of the bill is calculated to substitute *human* experimentation for *animal* experimentation.

I objected to the bill finally because inspection was to be carried on under the auspices of a society which has shown itself prejudiced on this subject.

Yours truly,

HORACE D. ARNOLD, M.D.

HENRY P. BOWDITCH

PROFESSOR OF PHYSIOLOGY, HARVARD MEDICAL SCHOOL

(Opening for the remonstrants.)

It is part of the price we have to pay for our free institutions that we must at all times be ready to defend the things we most cherish. "Eternal vigilance is the price of liberty;" and the saying seems to be as true of the liberty to study and investigate as of the political liberty with regard to which the saying originated. That the medical profession and the higher educational institutions of the State should be called upon to defend before a legislative committee their right to study and teach does not, therefore, surprise any one, least of all one who has watched the progress of the so-called anti-vivisection agitation during the last quarter of a century. The efforts of misguided benevolence have, at various times within this period, been directed to checking the progress of medical science by interfering with one of the most important methods by which advances can be made. Fortunately for humanity these efforts have in nearly all cases been rendered futile by the sound common sense of the community. In England alone of all civilized countries has a certain measure of success crowned the efforts of fanatical agitators, and by a restrictive law a serious blow has been inflicted upon English physiology. As this law has been freely quoted and recommended for imitation here in Massachusetts it may be well to consider the way in which it was passed

and the effect of its enactment. To this end let me quote the language of Lord Sherbrooke (better known as the Right Honorable Robert Lowe): [1]

> "The commission entirely acquitted English physiologists of the charge of cruelty. They pronounced a well-merited eulogium on the humanity of the medical profession in England. They pointed out that medical students were extremely sensitive to the infliction of pain upon animals, and that the feeling of the public at large was penetrated by the same sentiment. . . . They then proceeded to consider to what restrictions they should subject the humane and excellent persons in whose favor they had so decidedly reported. Their proceeding was very singular. They acquitted the accused, and sentenced them to be under the surveillance of the police for life."

Remarkable as was this conclusion of the commission, the action of Parliament based upon it was still more extraordinary, for a law was enacted which, taken in connection with the previous legislation, has brought about a state of things in England which has been well described as one "in which it is penal to use domestic animals in any way cruelly, but in which any one may torture wild creatures in whatever fashion he likes *provided it is not for scientific purposes.*"

A few extracts from the recently published letters of Huxley may also throw light upon the subject. Huxley represented physiological science on the Royal Commission referred to by Lord Sherbrooke, and these extracts show how far he was from assenting to the law as finally enacted.

[1] Contemporary Review, Oct., 1876.

LIFE AND LETTERS OF THOMAS HUXLEY[1]

(p. 467.) "Observation and experiment alone can give us a real foundation for any kind of Natural Knowledge, and any one who is acquainted with the history of science is aware that not a single one of all the great truths of modern physiology has been established otherwise than by experiment on living things." (Letter to Sir W. Harcourt.)

(p. 469.) "For the advantage and protection of society, we all agree to inflict pain upon man — pain of the most prolonged and acute character — in our prisons, and on our battlefields. If England were invaded, we should have no hesitation about inflicting the maximum of suffering upon our invaders for no other object than our own good.

"But if the good of society and of a nation is a sufficient plea for inflicting pain on men, I think it may suffice us for experimenting on rabbits and dogs." (From a letter to a student.)

(p. 471.) "In discussing the draft with Litchfield I recollect that I insisted strongly on the necessity of allowing demonstrations to students, but I agreed that it would be sufficient to permit such demonstrations only as could be performed under anesthetics.

"The second clause of the bill, however, by the words 'for the purpose of new scientific discovery and for no other purpose,' absolutely prohibits any kind of demonstration. It would debar me from showing the circulation in the web of a frog's foot or from exhibiting the pulsations of the heart in a decapitated frog."[2] (From a letter to Darwin.)

[1] Volume I. N. Y., Appleton, 1901.

[2] This would be also the result of House Bill 856, "painful and painless" demonstrations being alike prohibited.

(p. 473–4.) Referring to the bill actually adopted, Leonard Huxley says,[1] "The evidence on the strength of which legislation was recommended went beyond the facts, the report went beyond the evidence, the recommendations beyond the report, and the bill can hardly be said to have gone beyond the recommendations, but rather to have contradicted them."

(p. 474.) "As to the working of the law Huxley referred to it the following year in the address, already cited, on 'Elementary Instruction in Physiology.'" (Coll. Essays, iii. 310.)

"But while I should object to any experimentation which can justly be called painful, and while as a member of a late Royal Commission I did my best to prevent the infliction of needless pain for any purpose, I think it is my duty to take this opportunity of expressing my regret at a condition of the law which permits a boy to troll for pike or set lines with live frog bait for idle amusement, and at the same time lays the teacher of that boy open to the penalty of fine and imprisonment if he uses the same animal for the purpose of exhibiting one of the most beautiful and instructive of physiological spectacles — the circulation in the web of the foot. No one could undertake to affirm that a frog is not inconvenienced by being wrapped up in a wet rag and having his toes tied out, and it cannot be denied that inconvenience is a sort of pain. But you must not inflict the least pain on a vertebrated animal for scientific purposes (though you may do a good deal in that way for gain or for sport) without due license of the Secretary of State for the Home Department, granted under the authority of the Vivisection Act.

"So it comes about that, in this year of grace 1877,

[1] Quoting "Nature," 1876, p. 248.

two persons may be charged with cruelty to animals. One has impaled a frog, and suffered the creature to writhe about in that condition for hours; the other has pained the animal no more than one of us would be pained by tying strings round his fingers and keeping him in the position of a hydropathic patient. The first offender says, 'I did it because I find fishing very amusing,' and the magistrate bids him depart in peace — nay, probably wishes him good sport. The second pleads, 'I wanted to impress a scientific truth with a distinctness attainable in no other way on the minds of my scholars;' and the magistrate fines him five pounds.

"I cannot but think that this is an anomalous and not wholly creditable state of things."

(p. 463.) "When the course of instruction in physiology here was commenced, the question of giving experimental demonstrations became a matter of anxious consideration with me. It was clear that, without such demonstrations, the subject could not be properly taught. It was no less clear from what had happened to me when, as president of the British Association, I had defended Brown Séquard, that I might expect to meet with every description of abuse and misrepresentation if such demonstration were given.

"It did not appear to me, however, that the latter consideration ought to weigh with me, and I took such a course as I believe is defensible against everything but misrepresentation.

"I gave strict instructions to the demonstrators who assisted me that no such experiments were to be performed, unless the animal were previously rendered insensible to pain either by destruction of the brain or by the administration of anesthetics, and I have every reason to believe that my instructions were carried

out. I do not see what I can do beyond this, or how I can give Mr. Forster any better guarantee than is given in my assurance that my dislike to the infliction of pain both as a matter of principle and of feeling is quite as strong as his own can be.

"If Mr. Forster is not satisfied with this assurance, and with its practical result that our experiments are made only on non-sentient animals, then I am afraid that my position as teacher of physiology must come to an end.

"If I am to act in that capacity I cannot consent to be prohibited from showing the circulation in a frog's foot because the frog is made slightly uncomfortable by being tied up for that purpose; nor from showing the fundamental properties of nerves, because extirpating the brain of the same animal inflicts one-thousandth part of the prolonged suffering which it undergoes when it makes its natural exit from the world by being slowly forced down the throat of a duck, and crushed and asphyxiated in that creature's stomach." (Letter to Sir J. Donnelly.)

Another illustration of the working of the English law, as well as of the spirit in which the warfare against medical science is conducted, is afforded by the following extract from a pamphlet issued by the Society for the Abolition of Vivisection:

"THE BEGINNING OF THE END.

"The succeeding advertisement, publishing abroad a fact so important and encouraging to the cause, and so striking a proof of the success of our crusade, was inserted in the *Morning Post* of September 13, 14, and 15, 1881; *Nature* of September 15; the *Standard* of September 15, 16, and 17; the *Athenæum* of Septem-

ber 17; the *Times* of September 20, 21, and 23; the *Saturday Review* of September 24; and *Galignani's Messenger* of September 19, 20, and 21.

VIVISECTION, — THE BEGINNING OF THE END. The HOME SECRETARY has REFUSED CERTIFICATES to Professor Fraser, Dr. Lauder Brunton, and Professor Lister, for carrying on investigations which they declare to be of 'the highest value to Medical Science.'

"GEORGE R. JESSE,
"Hon. Sec. &c., Society for the Abolition of Vivisection.

"Henbury, near Macclesfield, Cheshire,
"10*th September*, 1881."

This advertisement also contains the answer to Senator Gallinger's request for information as to names of the distinguished scientists to whom licenses had been refused.

Such is the history and the result of English law which we are asked to imitate. That it is intended to, and actually does, interfere with research has been made clear, and I refrain from multiplying evidence of its disastrous effect upon English biological science. Its effect upon the freedom of instruction is equally apparent.

But does this law satisfy the anti-vivisectionists? By no means. Let them speak for themselves:

In an anti-vivisection pamphlet, entitled "Twelve Years' Trial of the Vivisection Act, — Has it stopped the scientific torture of animals in England?" by M. R. C. S., London, 1889, the English law is pronounced a failure.

The Illinois Anti-vivisection Society prints the following statement in its various publications:

> "The Restrictive Act, in England, after a trial of nineteen years, has failed to restrict — according to official returns. There is no reason to doubt it would be the same in America. The seventy-four societies of the world are demanding Total Abolition."

Testimony to the same effect has been offered at this hearing by several of the witnesses for the petitioners: they have advocated this bill because "half a loaf is better than no bread," and because it is "satisfactory for the present."

This is what the movement means, and its result, if successful, means the plunging of medical science into darkness worse than mediæval. To show that the blow is aimed at the practice of medicine as well as at medical science, let me quote from an address[1] of Henry Bergh, formerly president of the N. Y. S. P. C. A. and an ardent opponent of vivisection:

> "As another proof of the profane extremes to which these dissectors of living animals will go, Robert McDonald, M.D., on being questioned, declared that he had opened the veins of a *dying person*, remember, and had injected the blood of an animal into them, many times, and had met with brilliant success. In other words, this potentate has discovered the means of thwarting the decrees of Providence, where a person was dying, and snatching away from its Maker a soul which He had called away from earth!"

It seems to me that this blasphemous denunciation of a physician for saving a human life needs absolutely no comment.

[1] Delivered before a joint committee of both Houses of the N. Y. Legislature, Albany, Feb. 10, 1880.

I have used the words "misguided benevolence" in speaking of this agitation, and there is no doubt that the movement appeals to some of our noblest feelings — to the sentiment that bids us be merciful as we would obtain mercy. It is freely admitted that a large number (but unfortunately not all) of the persons engaged in this crusade are benevolent in their disposition and conscientious in their attitude; but it should be remembered that, as President Roosevelt once remarked, "Common sense without conscience may lead to crime, but conscience without common sense may lead to folly, which is but the handmaiden of crime." It has indeed been well said that "the excesses of virtue are more dangerous than those of vice because they are not restrained by the conscience."

With this introduction let us come to the specific case before us.

The medical testimony in support of the bill is surprisingly meagre. Many of the witnesses summoned were conspicuous by their absence. Those who appeared were chiefly homeopaths. Few had ever seen vivisections, and that only as students. Of those who had seen them, some thought them useful for instruction, others not; most of them admitted the value of experiments on animals in medical research. One witness did indeed testify that he would prefer to have a new surgical method tested on a patient rather than on a dog. We may hope for his own sake as a practitioner of medicine that his views on this subject will not be widely circulated in Roxbury.

We heard incidentally some interesting views on education; *e.g.*, that the training of the mind was no part of the education of a physician.

Experiments done in The Harvard Medical School have been quoted as evidence of abuse; of these and of the practice of vivisection in general Dr. Porter will speak.

Suffice it to say that the experiments alluded to were either painless, or that the pain was slight and its infliction quite justified by the importance of the result. Thus the experiments performed by Dr. Minot and myself were made to determine the influence of ether and chloroform on the nerve centres which control the circulation of the blood, and the results form part of the evidence which has convinced physicians that ether is a safer anesthetic than chloroform.

Of the physicians quoted in opposition to vivisection I shall refer only to Dr. Bigelow, because he is perhaps the most eminent, and is the only prominent physician in this community who has advocated these views. His opinions, as given in his address before the Massachusetts Medical Society June 7, 1871, are continually appearing in anti-vivisection literature. We must therefore try to estimate the value of his testimony. No one can fail to recognize the importance of Dr. Bigelow's contributions to surgical science and practice. In his own domain of surgery he was a brilliant operator, a tireless investigator of new methods, an able and effective teacher, but upon the question of vivisection his views seem to have been based upon what he had witnessed many years before at the veterinary school at Alfort (where undoubtedly many atrocities were committed), and he had not controlled these early impressions by any experience in modern physiological laboratories. It is evident, moreover, that whatever may have been Dr. Bigelow's views about vivisection in general, he could have had no fear that any objectionable practices would be permitted under the authority of Harvard University, for, in the same year in which he delivered the above mentioned address, the medical faculty, of which he was a most influential member, voted to establish its first physiological laboratory. No one familiar with the history of the school will believe that this could have been done had Dr. Bigelow seriously opposed it.

Dr. Bigelow's much quoted address does not, however, contain all that he has written on this subject.

In a volume entitled "Surgical Anæsthesia:" Addresses and other papers by Henry Jacob Bigelow, Boston, Little, Brown & Co., 1900, are published for the first time two papers on the subject of vivisection. In one of them, entitled "A letter to 'Our Dumb Animals,'" but never published by that journal, Dr. Bigelow writes as follows:

> "The question of pain leads to a part of the subject generally overlooked, which underlies the whole discussion. Let me briefly emphasize this. The real exception raised does not lie against vivisection, but against painful vivisection. The dissection of an animal in a state of insensibility is no more to be criticised than is the abrupt killing of it, to which no one objects. The confounding of a painful vivisection and an experiment which does not cause pain — either because the animal is under ether, or because the experiment itself is painless, like those pertaining to the action of most drugs, or because it is a trivial one and gives little suffering — has done great damage to the cause of humanity, and has placed the opponent of vivisection at a great disadvantage. If all experiments in physiology were as painless as those in chemistry, there would be but one side to this question. A painless experiment upon an animal is unobjectionable."

It is thus evident that Dr. Bigelow, were he alive to-day, would oppose the present bill, since painless and painful demonstrations are by it alike prohibited.

What is now the contention of the remonstrants against this bill?

In the first place, we resent with some indignation the intimation that we are less humane than our critics. We claim indeed that our humanity is of a higher order than

theirs, for it does not stop short with the lower animals, but extends itself over the human race, and, where the good of humanity requires it, we claim the right to sacrifice animal life, of course with as little suffering as is consistent with the object to be attained.

Of the necessity for such experiments and of the amount of suffering they involve we claim to be the best judges, for the study of such questions is the business of our lives.

It would be perfectly possible for me, Mr. Chairman, to bring before you a frog which would present all the external signs of suffering excruciating pain, but I should know, and every medical student who had studied the subject would know, that the animal could not possibly be suffering any pain at all. Of how much value under such circumstances would be the testimony of the agents of the Society for the Prevention of Cruelty to Animals?

The attitude of the medical profession on this question is perhaps best shown by resolutions passed in 1892 by the councillors of the Massachusetts Medical Society and by the society itself in response to a letter from the Massachusetts Society for the Prevention of Cruelty to Animals, and reaffirmed in 1896. They are as follows:

> "*Whereas*, The Massachusetts Society for the Prevention of Cruelty to Animals has asked for some official action on the part of the Massachusetts Medical Society in the form of a resolution, or otherwise, as to whether in their judgment, any law, and if so, what law should be enacted by our legislature to restrain or limit the practice of vivisection by physicians, medical or other students, or pupils in medical or other colleges or schools,
>
> "*Therefore*, Resolved,
>
> "I. That the Councillors are not aware that vivisections are practised in this State in an unnecessary or cruel manner.

"II. That the existing statutes furnish sufficient security against cruelty in vivisection as well as against cruelty in general.

"III. That experience has shown it to be very undesirable to impose restrictions of any kind upon the advancement of medical science by the researches of properly qualified persons.

"IV. That in view of the above facts, it is, in the opinion of the Councillors, inexpedient to legislate upon this subject.

"That a copy of the above preamble and resolutions be transmitted to the Massachusetts Society for the Prevention of Cruelty to Animals."

A list of sixty-eight scientific and medical societies (beginning with the National Academy of Sciences) which have adopted similar resolutions is given in Senate Document No 31, 54th Congress, 2d Session, Dec. 21, 1896.

We claim, then, that no abuse of the right to experiment upon living animals has been shown to have occurred in this State. We further claim that, should such a case arise, the existing laws provide a sufficient remedy and regard the contrary opinion of the petitioners as entitled to no consideration *until the inadequacy of the present statute shall have been demonstrated.*

In endeavoring to ascertain how much pain is inflicted in physiological experiments it must be borne in mind first, that the external signs of suffering are apt to be misleading; second, that even the higher domestic animals seem to have a sensibility to pain far less acute than that of man, as is shown, for instance, by the fact that a horse with a broken leg will limp about to graze, dangling the fractured limb behind him in a way which would cause a human being exquisite agony; third, that (according to Professor Yeo's

estimates, which have never been disputed) of the possibly painful experiments on animals

Seventy-five per cent are rendered painless by anesthetics.

Twenty per cent are about as painful as vaccination.

Four per cent are about as painful as the healing of a wound.

One per cent are about as painful as an ordinary surgical operation performed without anesthetics.

In inquiring how far this infliction of pain is justified by the benefits to the human race, we are struck by the fact that when the suffering of an animal has as a result an increase of human knowledge, the disproportion between the suffering and the benefit becomes practically infinite, for the suffering remains a constant quantity, while the benefit, since it accrues to the whole human race and through all time, is multiplied by an infinite factor.

It is hardly necessary, even were it possible, to enumerate all the discoveries that have been made in physiology by means of experiments on animals, for there is hardly a single organ of the body whose functions have not been investigated and explained in this way. It will suffice to quote the words of Dr. Loomis, who in his presidential address before the third Congress of American Physicians and Surgeons held in Washington in 1894, spoke as follows:

> "Every distinct advance, every established principle, and every universally accepted law of medical science has been in the past, and will be in the future, the indirect if not the direct result of animal experimentation."

With reference to this petition for the restriction of vivisection I desire to remind the committee that vivisection is already restricted. It is restricted in the first place by the general law against cruelty to animals, and in the second

place by the authority of the governing boards of the institutions in which vivisection takes place. These boards would be quick to correct any abuse of this practice which might be brought to their attention.

In the third place the practice is controlled by the regulations of the laboratories in which the work is done. Thus in the physiological laboratory of the Harvard Medical School the following rules are in force:

> "1. No experiments on animals shall be made except under the authority of the Director of the Laboratory.
>
> "2. No operations likely to cause suffering greater than that connected with etherization shall be made in this Laboratory, unless the animal experimented upon is rendered incapable of perceiving pain by drugs or by other painless methods of producing anesthesia.
>
> "Exceptions to this rule will be made by the Director only in those investigations in which the giving of the anesthetic would interfere with the object of the experiment. In such cases any preliminary operation likely to cause suffering must be made under anesthesia, and the anesthetic discontinued only so long as may be absolutely essential to permit the necessary observations.
>
> "3. At the conclusion of the experiment, the animal shall be killed in as painless a manner as possible, except in those cases in which the preservation of the animal's life is unattended by suffering or in which it is necessary to preserve life in order to determine the result of the experiment."

Vivisection is therefore already controlled by those who best understand the matter, *i. e.*, by those who best know the amount of pain inflicted and the necessity for its infliction.

In closing let us ask ourselves what legislation on this subject may be reasonably expected to accomplish. In answering this question the following propositions must be borne in mind.

1. Physics and chemistry are both experimental sciences; neither can advance except by the experimental method.

2. Physiology deals with the physical and chemical phenomena occurring in living animals, and is therefore also an experimental science.

3. Physiology is the only rational basis for medicine, for it is obviously impossible, without a knowledge of the normal functions of organs, as revealed by physiology, to understand those derangements of function which constitute disease.

It is evident, therefore, that medicine *must* advance by experiment in one form or another. Nothing that can be done in this State House can prevent that.

All that legislation can do is to determine to some extent who shall be the experimenters and who the victims, and to decide whether the "experiments shall be few, carefully planned, conclusive, and economical of animal life, or shall be numerous, accidental, vague, and wasteful of human life."

I think, in settling this question, that we may safely take for our guide the words of Him who said, "Ye are of more value than many sparrows."

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I

My first contact with medical education left an enduring mark. The medical students from the St. Louis City Hospital used to pass my home. I can see now the straggling groups of strange young men on their way down the broad, sunny street with the tall houses. We little boys, large-eyed with fear, peeped from a side yard. Nearer and nearer, along the brick pavement under the sycamore trees, came the confused tramp of student feet. Suddenly the air seemed filled with it. Terrified, we fled, our knees trembling beneath us. Safe in the forbidden kitchen, we listened with hearts thankful for our security while Black June declared: "Them stujents would sho'ly cut you up ef they was to ketch you!" June believed this fully, and her belief was shared by almost all the negroes and many of the poorer whites. As I grew older I heard dark tales of the medical school, — how McDowell's College had been threatened by a mob bent on putting a violent end to the practices within, how the young doctors at the City Hospital experimented upon the helpless poor, and many another fable that went from mouth to mouth, attacking the public trust in the men who had the public health in charge.

This was almost thirty years ago. Public opinion has changed somewhat since then. Cruel diseases have been conquered in this period, and the man in the street has more faith in doctors. Yet the errors of the present day

are not very unlike those of thirty years ago. Then the talk was of dissection, and the disgusting folly which forced tender youths to despoil the dead in order to learn facts already set down in books. To-day those bitter attacks are known only to the curious. The cry now is against vivisection. In this sober and educated Commonwealth of Massachusetts eminent citizens have been publicly accused of torturing animals behind bolted doors in our foremost institutions of learning. Thousands of pamphlets have been circulated to prove that the professors and governing boards of our leading universities have conspired to suppress the facts. It is asserted that the medical profession may sink to the vivisection of human beings, unless its doings be inspected regularly by the writers of these pamphlets and their friends.

This clamor in turn will pass away. All men will learn that as we go to Nature to study the structure of a dead body, so must we go to Nature to study the action of a living one. The agitation against animal experimentation will be forgotten, as that against dissection has been forgotten. Its place will be taken by some new cry; for the public feeling against the professions is based upon lasting causes, deep in human nature. A learned profession, such as medicine or the law, is a powerful combination of selected minds trained in a like way and bound together by like aims. Its power excites a slight distrust, and this distrust is strengthened by the layman's consciousness of ignorance and his feeling of unavoidable dependence. With rare exceptions, the law is sealed to all but lawyers, and medicine is a book which cannot be read by amateurs, though they love to thumb the leaves. No professions are more honored, but none are so much feared. Anti-dissection, anti-vaccination, anti-vivisection, and other attacks upon the medical profession are born of this vague distrust and traditional fear.

The otherwise amiable citizens who make these attacks cry to the doctors: "You torture dumb animals in your laboratories!"

Astonished at all this heat without visible fuel, the doctors reply: "You are mistaken. Most of our experiments are painless. The few exceptions are cases in which the ultimate purpose of the experiment, namely, the relief of suffering in men and animals, would be defeated by the use of anesthetics."

"We do not believe you," is the prompt retort. "Doctors cannot be trusted to speak ill of their colleagues."

"But you forget," the doctors answer, "that medical schools are university departments. The professors in the Harvard Medical School, for example, are appointed and controlled by the Corporation and Overseers of Harvard University. These are not medical bodies. You have asked three Massachusetts legislatures for police powers to enable you to enter Harvard laboratories at any time upon suspicion. Do you then believe that the President and Fellows of Harvard, or the governing board of any other university in Massachusetts, could fail to hear of atrocities committed in their own schools, or would fail to make the repetition of such atrocities impossible? Have you not been unable to produce at the legislative hearings any evidence whatever of the abuse of animal experimentation in Massachusetts?"

"Yes," is the reply, "it is true that we have thus far received from three committees of the legislature nothing but unanimous leave to withdraw; but we are sure that there would be evidence in plenty, if only we could get into the laboratories some day when we were not expected."

This is no imaginary sketch, but a faithful transcript of statements actually made. These attacks upon the liberty of research would never take place except for unmerited distrust of the universities and of the medical profession.

Any sort of experimentation by physicians is unpleasant to most men. It suggests that the art of healing is in a state of transition, as, indeed, it is. The idea is not attractive to patients, who become conservatives directly they fall ill. Only the physician can know how truly glorious are the fruits of experimentation in medicine. Others may reflect with satisfaction on the lowered death rate, the lessening of pain to men and animals, and the immense savings in money which have followed the systematic application of the experimental method in medicine. The physician remembers the child dying of a disease now curable — the mother numb with anguish, her famished eyes searching his face for the least hope, half-appalled, half-certain that death cannot come while he is with her. It is a bitter thought that each new triumph comes too late for many homes.

Sometime I shall write a book on "Lives I Might have Saved"— lives which were lost seventeen years ago in the general hospital in St. Louis. Had we known then what we know now, the father upon whom wife and child depended, the mother, the stay of her household, strong men fit to do the work of the world, youths of promise, would this day still walk the streets, happy in the love of kindred and of friends. Here and there solitary minds trained for work on the frontiers of knowledge were striving to pierce the gloom through which many a disease could be dimly seen marching to the fatal end. A few years more and the human beings whom I saw die would have been saved.

At the period of which I speak the City Hospital in St. Louis was a young institution, as age is reckoned in most communities; but it was old enough to have passed through terrible scenes. How easy to understand that twenty-five years ago those who entered hospitals left hope behind! Infection lurked within the walls, and from time to time became epidemic, raging like the plague. A pin

prick was then "a door open to death." Surgeons hesitated to operate. Opening the abdomen was called murder, so frequent and so fatal was infection in this operation. In the admirable "Life of Pasteur," for which we thank M. René Vallery-Radot, it is stated [1] that the Assistance Publique, hoping to overcome the almost invariably fatal results of ovariotomy in the hospitals, "hired an isolated house in the Avenue de Meudon, a salubrious spot near Paris. In 1863 ten women in succession were sent to that house. The neighboring inhabitants watched those ten patients entering the house, and a short time afterward their ten coffins being taken away. In their terrified ignorance they called that house the House of Crime."

In the Franco-Prussian war lives were twice risked — once in the field, again in the hospital. The needle-gun filled the wards; but gangrene emptied them. "During the siege of Paris, in the Grand Hotel, which had been turned into an ambulance, Nélaton, in despair at the sight of the death of almost every patient who had been operated on, declared that he who should conquer purulent infection would deserve a golden statue." [2]

Even more sad than these perils of war were the losses in child-birth. "In the year 1872 puerperal fever destroyed twenty-eight women of one hundred and twenty-six who were confined in the Bellevue Hospital. The service was then broken up, and a great outcry arose against 'tainted hospitals.'" [3]

These scourges of the hospital and the camp are gone. They have been conquered by the genius of Pasteur and by the penetrating mind of Lister. Many of Pasteur's experiments were performed upon living animals. His germ

[1] Life of Pasteur, translated by Mrs. R. L. Devonshire, vol. ii. p. 16.

[2] Ibid., p. 18.

[3] The Science and Art of Midwifery, by W. T. Lusk, New York, 1883, p. 640.

theory of disease, applied practically by Lister, has transformed surgery and obstetrics.

The beginning of wound-infection is lost in prehistoric time. What countless thousands have perished from this cause! Could the dead be summoned back, what throngs would rise to acclaim these benefactors of mankind! How moving is the thought that these researches will protect generation after generation, age upon age, so long as knowledge shall endure!

Antiseptic methods were actively used in the surgical wards of the City Hospital in 1885 when I became a resident physician, but they were far from the perfection they have since attained. The technique of abdominal operations was but little understood, and the mortality from wounds of the intestine and other injuries necessitating the opening of the abdomen was very great. The wonderful successes of abdominal surgery, based largely on experimentation upon living animals, were not then dreamed of. The surgery of the brain and the spinal cord had scarcely made a beginning; here, too, experimentation upon living animals had not yet led the way. But it is not my intention to relate the advances in medicine and surgery during the past seventeen years. This is not the place in which to tell the wonderful story of the conquest of hydrophobia nor to describe the campaigns against blood-poisoning, tetanus, myxedema, tropical diseases, snake venom, and the plague. I can but mention here the rapidly approaching downfall of yellow fever and malaria, the great reduction in the mortality from diphtheria and consumption, and the immense sums that have been saved the State by the new knowledge regarding anthrax, Texas fever, and other infectious diseases of domestic animals. Much of this beneficent work would have been impossible without experimentation upon living animals.

The imagination does not easily compass the vast issues

at stake. The Black Death, or plague, once swept away whole villages, and would do so again were it not for medical science. The power of the plague, even to-day, is almost incredible. In Undhera, an Indian village, with a population of nine hundred and fifty, half the men, half the women, and half the children in each household, were inoculated against the plague early in February, 1898. "The plague in the village lasted up to March 26, and fell on twenty-eight families. In these, there were sixty-four not inoculated, and seventy-one inoculated. The sixty-four had twenty-seven cases, with twenty-six deaths; the seventy-one had eight cases, with three deaths."[1] Almost every uninoculated person died. Some of the towns where inoculation was not practised lost half their inhabitants. "It is said that, in Italy alone, malaria keeps nearly five million acres of ground from cultivation, affects more or less sixty-three provinces and two thousand eight hundred and twenty-three communes, and every year poisons about two million people, killing fifteen thousand of them."[2] I remember that during my studies in the Pathological Institute in Kiel, about one in three of the patients dying of various disorders in the Charity Hospital of that city were found upon autopsy to be tuberculous. The proportion is no doubt larger in Holstein than in America, but in this country, as well as in Germany, tuberculosis has fairly earned its name of The Great White Plague.

Such accounts mean little to the layman, who has never fought a losing fight for human life; he reads them with temperate sorrow; but they rouse the physician and investigator like blows. One can but pity the misinformed enthusiasts who are responsible for the proposed interfer-

[1] From Haffkine's Report, cited in Experiments on Animals, by Stephen Paget, 1900, p. 151.

[2] Paget, loc. cit., p. 184.

ence with medical research. They are wrong in believing their fellow citizens to be less merciful than themselves, and doubly wrong in supposing that researches upon which depends the welfare of multitudes can be judged by the untrained and superficial. In reality enrolled against the humanity which they would serve, they are indeed blind leaders of the blind. There are some to whom agitation has become a necessary stimulant, and who drink a delusion as the victim of alcohol drinks rum. Such persons are, as a rule, impervious to evidence. The sane objector to animal experimentation would alter his opinion could he be brought to solid ground from out the clouds of prejudice and error which systematic agitation has thrown about this subject. Let him stand by the bedside of a child infected with laryngeal diphtheria. He marks the labored breathing, the small but frequent pulse, the pallid features, already slightly livid. He knows that diphtheria so far advanced as this is usually fatal. In his hand is a vial of antitoxin. Shall he use it — this new remedy that has reduced the deaths from fifty-five to ten in every hundred cases? Shall he give this product of the laboratories, born of experimentation upon living animals, prepared from animals and tested on them? He must make immediate choice. Death waits for his decision. What man of real humanity could hesitate? What will probably be the outcome should he refuse? The progress of this frightful disease has been thus described by a celebrated teacher:[1] "The difficulty of respiration increases in severity. Every hour, or every two or three hours, a suffocative fit comes on. The suffocative attacks follow one another more rapidly, and become more and more violent. From time to

[1] A. Trousseau, Professor of Clinical Medicine in the Paris Faculty from 1850 to 1867. The description here given is condensed from his Lectures on Clinical Medicine, delivered at the Hôtel-Dieu; translated by Sir John Rose Cormack and Dr. Bazire, vol. i, pp. 342–344.

time the infant, in a state of excitement which it is impossible to describe, suddenly sits up, seizes the bed curtains and tears them with convulsive frenzy; he throws himself on the neck of his mother or of those about him, embracing them and trying to clutch whatever he can as a something to hold by. At other times, it is against himself that he directs his impotent efforts, grasping violently the front of the neck, as if to tear out from it that which is suffocating him. The puffy, purple face, and the haggard, sparkling eyes express the most painful anxiety and the most profound terror: the exhausted child then falls into a sort of stupor, during which respiration is difficult and hissing. The face and lips are pale, and the eyes sunken. At last, after a supreme effort to breathe, the agonies of death begin, and the struggle ends."

I wonder that we, who know what joy the fruits of animal experimentation have brought to many families, can sit with patience while the petitioners for the restriction of medical research discuss man's place in nature and his attitude toward the brute creation. "Do I believe we are justified in sacrificing animals for the good of man!" exclaimed a distinguished pathologist at one of the committee hearings. "Why, I would sacrifice a whole nation of cats to save one child."

II

Animals are even more indebted than man to animal experimentation. It is not too much to say that experimentation upon animals during the past twenty-five years has accomplished more to the relief of animals themselves than all former efforts taken together.

Consider the ravages of Texas fever, now rapidly diminishing, chiefly because of the discoveries of Dr. Theobald

Smith, Professor in the Harvard Medical School. Think of the losses from anthrax, or charbon, or splenic fever, as it is variously called. In the Russian province of Novgorod, five hundred and twenty-eight men and fifty-six thousand cattle, horses, oxen, cows, and sheep died of anthrax between 1867 and 1870. In 1877, when Pasteur began his studies of anthrax, the "French provinces of Beauce, Brie, Burgundy, Nivernais, Berry, Champagne, Dauphiné, and Auvergne paid a formidable yearly tribute to this mysterious scourge. In Beauce, for instance, twenty sheep out of every hundred died in one flock; in some parts of Auvergne the proportion was ten or fifteen per cent, sometimes even twenty-five, thirty-five, or fifty per cent. At Provins, at Meaux, at Fontainebleau, some farms were called *charbon farms;* elsewhere, certain fields or hills were looked upon as accursed, and an evil spell seemed to be thrown over flocks bold enough to enter those fields or ascend those hills. Animals stricken with this disease almost always died in a few hours; sheep were seen to lag behind the flock, with drooping head, shaking limbs and gasping breath; after a rigor and some sanguinolent evacuations, occurring also through the mouth and nostrils, death supervened, often before the shepherd had had time to notice the attack."[1] In Beauce, in some particularly bad years, the loss in money is said to have reached twenty million francs.

Not less affecting is this picture of another infectious disease — a disaster of the farmyard. "Hens, believed to be good sitters, are found dead on their nests. Others, surrounded by their brood, allow the chicks to leave them, giving them no attention; they stand motionless in the centre of the yard, staggering under a deadly drowsiness. A young and superb cock, whose triumphant voice was yesterday heard by all the neighbors, falls into a sudden

[1] Life of Pasteur, vol. ii, p. 45.

agony, his beak closed, his eye dim, his purple comb drooping limply. Other chickens, respited till the next day, come near the dying and the dead, picking here and there grains soiled with excreta containing the deadly germs; it is chicken cholera."[1]

Imagine the suffering caused by hog cholera. "No State is exempt from hog cholera, and in some communities it amounts to a calamity. It has been estimated that in Iowa alone the value of the animals lost by cholera was from $12,000,000 to $15,000,000 in one year, and some have placed the losses of the entire country at $100,000,000. These astounding figures are certainly not exaggerated."[2]

The inoculations which protect animals against anthrax, chicken cholera, and swine plague were discovered by Pasteur by means of experimentation upon living animals. No wonder that the researches of this extraordinary man moved Huxley to declare in a public lecture to the Royal Society: "Pasteur's discoveries alone would suffice to cover the war indemnity of five milliards paid by France to Germany in 1870."

A petitioner for the first bill against animal experimentation introduced himself to the committee as Justice of the Peace and Friend of Dumb Animals. It is pleasant to be known as a friend of dumb animals, but which is the true friend — he who would hinder animal experimentation, or he who would sacrifice a few, or even many hundred animals, to diminish the suffering and prolong the lives of innumerable thousands?

[1] Life of Pasteur, vol. ii., p. 97.

[2] Report of U. S. Bureau of Animal Industry, 1898, p. 249.

III

The animal body has been aptly compared to a country composed of many separate and individual States. As the citizens of one State differ from those of another State, so, but in a greater degree, the cells of one organ in the body differ from those of other organs. The liver and the spleen are commonwealths, each with a characteristic population of cells. Anatomy describes the form and structure of these various organs.

Physiology is the study of the action of the organs as individuals and as parts of a living whole. The anatomist would describe the locomotive as it stands fireless upon the track. The physiologist would study it in motion, note the coal consumed, the water converted into steam, the load drawn, the speed, the method of control. The anatomist describes the structure of the heart, measures its weight, and states its position in the chest. The physiologist studies the functions of the heart, the way in which it pumps the blood, the working of its valves, the sounds that mark its beat, the passage of the contraction wave from apex to base, the quantity of blood thrown into the arteries, the nutrition of the heart-muscle, and the control of the heart by the brain and the nerves.

Pathology, or the science of disease, rests upon anatomy and physiology. The pathologist studies the structure and the function of diseased organs. As the alterations in structure which are the consequence of disease cannot be recognized without accurate knowledge of the structure of the organ in health, so the alterations in function which are the symptoms and signs of disease cannot be recognized without accurate knowledge of the function of the organ in health.

Practical medicine answers the patient's three questions: What is the matter? When shall I be well? What shall

I do? The diagnosis and prognosis depend almost entirely upon pathology, physiology, and anatomy, and the treatment, so far as it is rational and not empirical, is the expression of our knowledge of the physiological action of the remedies employed. Medicine is a fire kindled upon a tripod. It would be thrown down were either anatomy, physiology, or pathology taken away. In heart disease, for example, the diagnosis depends chiefly upon the recognition of an increase in the size of the heart, and of a change in the character of the heart sounds. How could the dilatation of the heart be recognized were the size and outlines of the healthy organ not accurately known? To decide which valve gives forth the abnormal sound, not only must the sounds in health be mastered, but there must be precise knowledge of the course of the blood within the chambers of the heart. To determine how long the diseased heart will bear its burdens requires a wide knowledge of the anatomy, physiology, and pathology of the circulation and of the lungs, liver, and kidneys, organs speedily affected by most disorders of the heart. Anatomy, physiology, pathology, and practical medicine meet at the bedside — a blow at one is a blow at all!

The function of an organ cannot be learned by the contemplation of its structure. The heart and the blood-vessels were known to the ancients; but the discovery of the circulation of the blood waited fifteen hundred years for Harvey's "frequent examination of many and various *living* animals."[1] The thyroid gland had been known from early times; but the discovery of its function and the consequent discovery of the remedy for myxedema and cretinism was the fruit of recent experimentation upon animals.

Nor can the truth of physiology be taught without recourse to living tissues. At a recent hearing before the

[1] Harvey: De Motu Cordis et Sanguinis in Animalibus.

legislature the counsel for the petitioners sought to prove that in teaching a natural science, such as physiology, demonstrations are no better than books. Most of the persons whom he brought forward to support this mediæval notion had never seen any physiological experiments. One witness, who was once a teacher of anatomy, believed that the structure of a dead organ could not be learned without studying the organ itself; but she was sure that the action of that organ in life could be learned from a book. It is perhaps natural that those who confess that they have not seen Nature, but have only heard about her, should try to comfort themselves with the idea that hearsay is like personal acquaintance. This is a delusion which is increased by their incapacity to appreciate the fundamental difference between the natural sciences and other disciplines, for example, mathematics and the law. It is true that in both the natural sciences and the law the student is now directed to the original source — in science to the natural object or process, in law to the cases and decisions, which are in fact the law. But there is this important difference. The material of the law is in books. Words give with accuracy the principles and rulings which constitute the law. It is not so in natural phenomena. These cannot be well described. If words could serve, the blind would see. You cannot know a man's voice until you have heard it. In the Harvard laboratory for physiological research the Committee on Probate and Chancery of the last legislature were shown the heart of a tortoise which had been taken from the body after the head of the animal had been cut off. A glass tube had been fastened in an artery leading from the heart and a second glass tube in a vein leading to the heart. The extirpated heart was pumping steadily. The blood which was allowed to flow from a reservoir into the organ through the venous tube was pumped up through the

arterial tube into the reservoir again. The preparation had been placed in a small bottle and was passed from hand to hand. The committee thought it a wonderful sight; and so it was. It could not have been described.

No one would intrust an express train to an engineer who had studied only the picture of an engine in a book. The body is a machine much more intricate than a locomotive. No one would willingly employ a physician who had never seen a patient. Yet there are many books that describe as well as books can the symptoms of disease. Disease is the abnormal action of living organs; physiology treats of their normal action. If their abnormal action cannot be learned from books, neither can their normal action.

The committee also visited the laboratories in which the medical students were performing physiological experiments. There they saw about two hundred men at work. Each student was provided with a desk and the apparatus necessary for his experiments. The work was done for the most part upon frogs; but the students performed many experiments, as, for example, those on the pulse, upon each other.

The petitioners who desire that medical students be taught physiology from books have insisted that observations made upon the lower animals cannot be applied to human beings. The petitioners are correct in believing that there is a great difference between the lower animals and man. They fail, however, to understand that this difference concerns the highest functions of the nervous system — the sensations and perceptions, and especially the perception of pain. In this respect the difference is, indeed, great; but it ends here. The fundamental phenomena of life, such as the action of the heart, and the function of the muscles and the peripheral nerves, are remarkably alike in all vertebrates. A very large part of

our knowledge of these functions is derived from studies made upon the frog and other animals low in the scale of life. The students may therefore learn these phenomena from experiments upon frogs.

The majority of the experiments which the students perform are made upon "surviving" parts. The head of the frog or tortoise is cut off, or the brain is painlessly destroyed. The pain-perceiving organ is thus removed. The animal is in the legal sense dead; but the heart may continue to beat, and the muscles and nerves may remain alive for a considerable time. If from such an animal the gastrocnemius muscle, the principal one in the calf of the leg, be removed together with the branch which it receives from the sciatic nerve, the muscle will shorten, or contract, when the nerve is stimulated, and will lift a weight.

The students in the regular courses in the Harvard Medical School do not operate upon warm-blooded animals. The number of such animals used for purposes of instruction is very small. For the demonstrations to be given in 1902 before the class in physiology, two pigeons, six rabbits, and two dogs will be required. Such animals are always fully anesthetized, and suffer no pain whatever.

There is great misunderstanding regarding the nature of physiological research. Many of the laity believe that the terms physiologist and vivisector are identical, whereas the majority of physiological investigations require no operations on living animals. Equally erroneous is the idea that investigations are pursued by incompetent students. Of the thirty-four investigations published in the last six years by the Department of Physiology in the Harvard Medical School only three were made by students. One of the three did not require any operation upon animals, the other two were performed under the personal supervision of a professor, and with his assistance.

When a dog is brought to the laboratory for operation he is given a hypodermic injection of morphine. After the morphine has taken effect, the dog is fastened upon the operating table. By this time he does not feel the discomfort of being tied down. He is then fully anesthetized with ether. Rabbits are fastened upon rabbit-boards and anesthetized with a mixture of three parts of ether and one of alcohol. As a rule, we do not employ chloral, for observation shows that the American rabbit is killed by a dose which the European rabbit bears safely. Cats cannot, of course, be handled like the rabbits. The cats are placed in a small box. A small box is chosen in order that when the ether is poured into it and the animal attempts to escape from the fumes of the anesthetic, his movements shall be so limited that he cannot suffer by them. After full anesthesia is reached, the cat is taken out and fastened to the holder, while the anesthetic is continued.

In researches upon the physiological action of drugs it is not always possible to keep the animal anesthetized throughout the experiment, for the reason that the effect of the anesthetic on the heart-beat, the secretions, and other functions might conceal the effect of the drug which is being studied. In such cases the animal is anesthetized during any necessary operation, — for example, the insertion of a cannula into the carotid artery in order to record the blood-pressure, — and then the anesthetic is partially or wholly withdrawn, while the effect of the drug is tested. The inexperienced, seeing the open wound, would suppose that the animal must suffer keenly; but this is not the case. A wound made with a sharp instrument is not necessarily painful, even in man. The pain of wounds comes from pressure upon the sensory nerves, — as, for example, when the bruised part swells and the liquid which causes the swelling presses upon the nerves, — or

from chemical stimulation, when the drying of the wound alters the chemical composition of the liquids which surround the nerves. In physiological experiments there can be no pressure because the wound is open, and chemical stimulation by drying is prevented by moistening the cut surface either with the natural liquids of the tissues or with artificial solutions the composition of which accords as closely as may be with that of the natural liquids. Indeed, these investigations could not be made if the animal suffered. The suffering would alter the blood-pressure and other functions and thus destroy the value of the experiment. Moreover the animal would struggle and the sensitive recording apparatus could not be used. Struggling, however, is not in itself a trustworthy indication of suffering. The fowl whose head has been cut off feels no pain; it is dead, but its muscles remain for a time alive, and dash the body about the barnyard until the lack of oxygenated blood ceases to stimulate the motor nerves. Patients to whom ether or chloroform is administered may struggle long after consciousness is lost. A safer guide than struggling is the effect which pain has upon the respiration and the circulation. The stimulation of any sensory nerve will affect these functions, and no considerable degree of suffering can be present without causing a noticeable change in the heart-beat and the breathing.

We read in the newspapers that discoveries are largely matters of accident. The popular opinion is that the physiologist gropes about in the viscera of a living animal in the hope of stumbling upon some fact which may make him famous. Nothing could be farther from the truth. Research is a systematic, well-ordered business, with definite rules of procedure. A man who applies to us for a research expects: first, a problem so framed that its answer will be a new truth; second, a method by which the problem may be successfully attacked; third, assistance in

the making of experiments that shall answer the proposed question Yes or No. Let me illustrate this by one or two examples. A young investigator was recently given this problem: The effect of changes in the blood-supply of the heart muscle upon the rate and force of the heart-beat. He was furnished with a method by which the quantity of blood which flows through the walls of the heart — that is to say, through the heart muscle itself — could be accurately measured and varied at will. The animal was anesthetized with ether, and while still under the influence of the ether was bled. The heart was removed from the dead animal and was kept beating with the defibrinated blood of the same animal. It was discovered that the rate of the pulse, that is the number of heart-beats per minute, might remain almost unchanged in spite of wide variations in the quantity of food supplied to the heart muscle; but the force of the beat was found to vary directly with the food supplied. The bearing of this investigation upon practical medicine must be obvious to every one.

The arteries which feed the substance of the heart are frequently diseased. Their walls may become so thickened that the blood may have great difficulty in reaching the muscle-cells of which the heart is composed. Then the ill-fed organ cannot do its work, and may suddenly give out. Heart starvation is a frequent cause of sudden death. In the course of the investigation just mentioned it was observed that the heart received a significant supply of blood through the vessels discovered by Thebesius in 1708. No one had supposed that these minute channels, which pass from the cavities of the heart into its walls, had any part in the nutrition of the organ; the nutrition of the heart was thought to be the exclusive function of the cardiac arteries. This new idea was the starting-point of another investigation. It was found that the heart might be kept beating for hours while its arteries were empty, pro-

vided it were fed through the vessels of Thebesius. This discovery explains how life may sometimes be prolonged for years in spite of the excessive narrowing, or even obliteration, of many of the nutrient arteries of the heart.

It is in this systematic way, step by step, that Science proceeds into the unknown.

IV

The men who make discoveries lead toilsome lives. Iron industry, tenacity of purpose, and profound sagacity led Harvey to the discovery of the circulation of the blood. We look with amazement and with reverence upon the labors of Pasteur. Few may achieve such greatness, but all who set forth to find new truths are inspired by the hope of adding, in some degree, to the happiness and welfare of their fellow-men. To charge the investigator with inhumanity is as illogical as it is unjust. To demand that his researches shall be placed under the supervision of the humane societies is unwise. What society approaches the practical humanity of the men engaged in medical research? Biological research is already in the hands of the governing boards of incorporated institutions of learning. These boards are composed of the most distinguished citizens. Yet the little group of agitators are not satisfied. They wish the control of research to be placed in their own hands.

I say "the little group of agitators" advisedly. The persons who are responsible for these several attacks upon research may be counted upon the fingers. Many of them have declared publicly that animal experimentation is useless and morally wrong. Against the "vivisectors," as they call them, they have exhausted epithet and invective. Taught by previous failures that restriction equivalent to abolition of animal experimentation cannot be obtained at

present, they seek now an entering wedge. But upon what evidence do they assert that the present stringent law against cruelty to animals cannot prevent or punish the imagined cruelties of university professors? The law has not been tested. The men charged with "atrocities" have not been prosecuted. The plain truth is that you cannot prosecute without evidence — upon mere suspicion.

The most moderate legislation proposed by the petitioners demands (1) that animals shall be anesthetized throughout experiments which may cause pain; (2) that such animals shall be killed at the close of the experiment while still under the influence of the anesthetic; and (3) that the agents of any incorporated society for the prevention of cruelty to animals shall be at all times permitted to enter any place where such experiments are performed, in order that they may determine and report whether the experiments are humanely conducted.

The petitioners ask, therefore, that experiments in medicine and other biological sciences be placed under the supervision of the authorized agents of any humane society now existing or hereafter incorporated. Such a request is based upon the assumption that supervision exercised by these societies through their agents will prevent the cruelties which the petitioners believe to be now practised in spite of the existing supervision by college faculties and governing boards. This extraordinary assumption rests upon the further assumption that the humane societies are competent to pronounce upon the value of medical research and upon the technical details by which it is carried on.

The bills which the petitioners have presented have been discussed at great length before the committees of three legislatures. The petitioners are therefore well acquainted with their subject. The earlier bills were drawn with an ignorance of animal experimentation remarkable in persons so ready to assume such grave responsibilities. But

these errors, natural enough in those who meddle with the business of experts, were pointed out at the public hearings. Their latest demands, therefore, must have been framed with all the skill and knowledge that the petitioners possess.

It will be interesting to inquire whether the demands now made present internal evidence of that profound acquaintance with medical science that should fairly be expected from the petitioners for legislation so important to the public health.

The proposed legislation permits the considerable pain of hydrophobia or other disease with which an animal may be painlessly inoculated, but directs that the animal shall be killed at the conclusion of any painful operation without regard to whether the animal would recover from the operation without pain or with far less pain than that experienced in the course of a disease produced by inoculation. This provision excludes absolutely many fields of medical and biological research. A large part of our knowledge of digestion comes from observations upon animals in which an external opening has been made into the stomach or intestine. The opening is made under the influence of anesthetics. The recovery from the necessary operation is almost or quite painless. After recovery the process of digestion may be watched through the artificial opening, and the digestive juices may be obtained in their natural state. These valuable observations could be no longer made. Great advances in practical medicine have followed the prolonged study of animals from which certain organs, such as the stomach, pancreas, and thyroid have been removed. The operation is performed under the influence of anesthetics and the recovery is almost or quite painless. Such experiments also are excluded. This legislation would put an end to researches on the repair of fractures, the healing of wounds, the mode of union of

severed nerves, the recovery from loss of blood, the removal of portions of the brain to determine how much the surgeon may safely take away when he operates for tumor or abscess, and many other studies indispensable to the progress of medical science.

Probably the framers of the proposed legislation wished that investigation of the action of remedies should continue. The ignorance with which their proposals are made is again shown here. The action of drugs cannot be studied without connecting the blood-vessels or other parts of the body with recording apparatus. An operation is usually necessary. This operation is performed under the influence of anesthetics, which must then as a rule be discontinued in order that their influence upon the heart and other organs shall not conceal or distort the effect of the drug which is being investigated. It has already been pointed out that the suspension of the anesthetic at this point causes little or no suffering; but the petitioners demand that the anesthetic be continued throughout the experiment.

But why continue this catalogue of blunders! Shall we place in ignorant hands the control of researches which lessen pain and lengthen life, or shall we leave with experts that which is their province?

If such mistakes are made by the most instructed of the petitioners — those who framed the proposed legislation — what may be expected from persons who can be persuaded to become agents for the enforcement of this legislation? What man with sufficient character and expert knowledge to justify his appointment will consent to burst into the private laboratory of the medical investigator in order to surprise him at his experiments? Imagine the professor at his task. He is studying the effect of a new remedy. Can this drug be given safely to patients with weak hearts? The heart of the animal is beating in the opened

chest. The lungs are moving. Sensitive recording levers are tracing upon a revolving drum covered with smoked paper a highly magnified record of the changes in the heart-beat and the respiration. The investigator moves on tip-toe, for fear of making the floor vibrate. He knows that even the jar caused by the passing of a heavy cart in the street may be recorded by his magnifying levers. He is tense with the effort of controlling all the complex detail of the fast-moving experiment. The blood supply to the heart, the air for the lungs, the revolving record, the solution of the drug, and a dozen other matters — all must be watched at once. Eyes, ears, and hands must be constantly occupied. In this crucial moment the door flies open and in walks the agent. In a trice the experiment is ruined, — the fruit of anxious hours is gone. The animal is sacrificed for nothing. The practitioner must wait till another time for knowledge of this remedy. The zealous agent bustles about the room. Such delicacy of feeling as may be left in a man who will accept such duties impels him to justify himself, if possible.

"What anesthetic are you using?" he asks the indignant scientist.

"None. The animal is dead."

"What 's this? The animal dead? Preposterous! Why, can't I trust my own eyes? Here is the heart beating regularly, and the lungs are moving, too."

Imagine the report. How will the man speak of this profound and humane investigation? How will he know that the heart and lungs have been kept alive by the skill of the scientist, while the rest of the body has been allowed to die?

The proposed legislation will, beyond all question, put an end to many investigations in medicine and biology, and will hamper the researches which it does not prevent. Those who advocate the restriction or the abolition of an-

imal experimentation should weigh their purpose well. A great philosopher has stated clearly the inevitable consequence. Darwin wrote in 1881: "I know that physiology can make no progress if experiments on living animals are suppressed, and I have an intimate conviction that to retard the progress of physiology is to commit a crime against humanity." [1]

[1] From a letter to Pasteur dated April 14, 1881. Life of Pasteur, vol. ii., p. 149.

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THE VALUE OF ANIMAL EXPERIMENTATION IN PATHOLOGY

THE great advance in the art of medicine which has come in the last forty years has been due to a greatly increased knowledge of disease. In acquiring this knowledge, observation and experiment must go hand in hand. The study of the phenomena of disease, with their description and classification, though important, will not suffice. To explain the phenomena observed, recourse is had to hypothesis, and this must be proved by the experiment. There was but little experimental study of disease prior to 1860, and many of the theories which were advanced in explanation of phenomena and on which methods of treatment were instituted are known now to have been utterly erroneous. The theory of crasis advanced by so great an observer as Rokitansky, and which by its general acceptance greatly retarded the advance of knowledge, fell when subjected to the experimental test. By the method of observation we are limited to the study of phenomena exhibited by the sick individual, those variations from normal function which are called symptoms, and the changes in the structure of organs seen in the post-mortem examination to which the symptoms are supposed to be due. To explain the connection between the two, hypotheses must be advanced, and the hypotheses must be

laboratories in connection with the hospitals, in which not only are methods of diagnosis carried out which cannot be made at the bedside, but in which disease is studied with the view that the knowledge gained can be utilized by others. In the work of the laboratory animal experimentation is necessary. The inoculation of animals with a disease often affords the earliest and the surest method of diagnosis, and in some cases it is the only one. The treatment of the sick is directly dependent upon the diagnosis, and it often happens that an early and certain diagnosis makes the difference between life and death. The hospital records contain many cases which show that the lives of patients have been saved by methods of investigation which could only be carried out in the laboratory and in which animal experimentation has been utilized.

In teaching pathology, animal experimentation is necessary. The student must *see* things and not be simply told about them. He must see not only what *has* taken place, but what *is* taking place. The changes in the circulation which form a great part of the phenomena of inflammation can only be understood by study of the circulating blood in the web of the frog's foot. He can only understand anatomical changes by observing the stages of their formation. He must himself inoculate animals and see the development of disease.

There are two considerations which show especially well the importance of animal experimentation in acquiring knowledge of disease. This knowledge has advanced more rapidly in the last fifty years than in the previous five hundred. It is only in the last fifty years that the methods of investigation which are used in all natural sciences have been applied to medicine.

These methods are observation and experiment.

It might be possible for an individual to retire into a cave in the desert and write poetry, or even evolve a system

of philosophy; but science cannot be studied in this way. There is no short, no easy way.

There are certain diseases in the study of which it has not been possible to utilize animal experimentation, and in these diseases there has been no advance of knowledge, and our power to relieve is correspondingly deficient. This is true in certain changes in the blood, as leucemia and anemia, and in certain of the malignant tumors, and in such infectious diseases as syphilis and leprosy. In the case of the malignant tumors, however, there is a fair prospect, since we have begun to apply experimental methods to their study, that our knowledge, and with that our power to relieve, may be increased.

THEOBALD SMITH

PROFESSOR OF COMPARATIVE PATHOLOGY, HARVARD MEDICAL SCHOOL

In 1896 Harvard University established a department or chair through the agency of which the study of disease in its various manifestations was to be extended to animal life. Disease wherever it might appear in the animal world was to be studied for two purposes:

1. To extend any knowledge obtained in this way to the study of human disease and its amelioration and prevention.

2. To apply such knowledge to the suppression and eradication of the plagues of animal life.

Like physiology, this department of general or comparative pathology must apply its inquiries to animal life because, like physiology, it must experiment rather than merely observe. As a representative of that department of medical inquiry I must therefore take cognizance of this bill, because, if enacted into law, it would seriously hamper by its restrictions that progress in the study of disease which we all expect from properly conducted laboratory research.

Even the most careful scrutiny of the beginnings, course, and termination of spontaneous animal diseases does not enable us to penetrate much below the surface. Such study must be followed by a minute analysis, which is only made possible by carefully planned experiments which enable us to estimate the value of the various factors which lead to and induce disease. Here it is where animal experimentation must enter. By properly planned experi-

mentation we may allow each separate cause of disease to act by itself, so that we may know its relative importance and the part it plays in the complex human diseases which we can only observe from the outside, as it were. Nor can we stop at inoculation experiments, as the promoters of this bill would have us do, for instance, in the study of germ diseases. The inoculation simply reproduces for further study those diseases of man which can be produced in animals, and it enables us to study diseases which are still far away but threatening invasion. In this way the bubonic plague and Asiatic cholera were studied, so that, in cases of importation, the medical profession might use preventive measures intelligently. Simply repeating nature's methods does not necessarily reveal their mechanism to us. We must go further and make a minute detailed study of the sick animals. The promoters of this bill say: You may inoculate animals, but you must let them severely alone afterwards. Such a position enacted into law would throw the whole machinery of the public-health laboratories into confusion. It would interfere with the production of antitoxin, since it would forbid the bleeding of horses to obtain the curative agent for which the horses are inoculated. Every new experiment would require legal interpretation before it would be safe to carry it out. In short, inoculation experiments, unless for diagnostic purposes, are useless unless the inoculated animals can be studied along chemical and physiological lines. Are the petitioners competent to tell us where to stop in order to make our labors useful ? Are they or their agents competent to draw the line between that which is necessary and useful and that which is unnecessary and useless? Are they in a position to determine whether an anesthetic is necessary or even desirable and when it is not? Do they know when and how much any particular animal is suffering?

It seems to me that there are two quite different ways of estimating pain and suffering. One is to take a highly subjective view of animal life and to project our own sensitive and in many cases hypersensitive nature upon animals; in other words, to make animals human. The other is to study animals themselves, to observe carefully the differences between the behavior and the actions of an inoculated or operated animal and the healthy one near by. If we wish to learn how to estimate suffering we must not only carefully study the differences between sick and well, but we must carefully avoid comparing a sick dog with a healthy guinea pig, or an operated rabbit with a normal cat. We must use strictly scientific methods to learn where suffering occurs, so that we may avoid it. The squeal of a guinea pig whose hair is being cut must not stampede us from doing important work. Which method of estimating cruelty and suffering is to prevail, the first or the second, the observational or the subjective and hysterical?

In the statements of the petitioners and in the various pamphlets issued by humane societies we continually encounter the veiled or open accusation that operations on animals are a great joy to the investigator, towards which he gravitates through the pull of an inborn cruelty. This view could only arise in the imagination for the following reasons:

1. The success of investigations requires that animals be kept in the best surroundings available.

2. Animal experiments are costly; the purchase and the care is expensive.

3. The actual operation is only the basis of many divergent investigations in physics, chemistry, microscopy, etc., in which animals do not figure at all. The more biological science progresses the more important these collateral studies become, the animal experiment being simply the starting point. Even if the experimenter were simply to

gloat over the quiverings of animal flesh, it would be a losing game for him, and his employment would soon come to an end. No institution would supply the funds for such personal pleasures.

In contrast to this imaginary picture, upon whose injustice and cruelty I need not dwell, let me place the vivisector so-called in another light. Let me say in the beginning that if there be any brutalizing of human nature, any lowering of the moral sense and blunting of humane instincts, they are due not to the operations and experiments on animals, but to the necessity of associating with the brute. The investigator is at a disadvantage in that his associates are animals rather than human beings, in which the elemental instincts of the brute are at all times cropping out. In fact there is nothing so disheartening as to witness the sudden manifestations of savagery of animals towards one another which may bring to nought laborious experiments.

I wish to appeal for the investigator rather than against him for doing disagreeable work in disagreeable surroundings for the good of society. There would be to-day a great exodus from biological and medical laboratories if those engaged in work there were convinced that their work was of no benefit to mankind or if mankind repudiated it. I believe that I can safely say for those whom I know that this is all that is keeping them there.

The use of animals in this work has come to stay, unless indeed science should advance so far as to substitute in some cases, at least, chemical for biological tests, as for instance a chemical test for diphtheria toxin and antitoxin. Society cannot dispense with them at present. We might as well go back to the sun-dial and the hour-glass. But how can we advance towards better methods if the utility of investigations is to be passed upon by any but the most highly trained? The work that led up to Behring's anti-

toxin would probably have been condemned as both useless and cruel by the petitioners.

Let me now briefly state my objections to the bill before us:

1. Section 1 *a* limits experimentation in such a way that the very large field of animal diseases is excluded. Though in most cases of indirect benefit to human medicine, experiments in this field are as a rule undertaken solely for the suppression and eradication of animal plagues, *i. e.*, for economic means. The bearing of this paragraph (*a*) upon the performing of painful operations upon domestic animals without the use of anesthetics — such as dehorning cattle, castrating, caponizing, and spaying — remains doubtful. These operations are as a rule performed without the use of anesthetics.

This paragraph furthermore brings out by contrast the fact that any man by assuming the title of veterinarian may perform painful operations upon animals. This Commonwealth has refused to protect the educated veterinarian by licensing him, although such limitation was strongly urged several years ago by the ablest veterinarians of the State.

This same paragraph may also interfere with certain work of the Massachusetts Agricultural College at Amherst.

Section 1 is essentially a blow at advanced methods of instruction now generally adopted in all teaching of natural science. The fundamental principle involved is that no student should be forced to accept any other person's description or interpretation of any phenomenon which he can with but little extra labor investigate for himself. The section also deprives young men of the opportunity of preparing themselves to become assistants until practically too late.

Section 1 *b*, and indeed the whole bill, by restricting its privileges to the graduate physician and surgeon, and

assuming that disease and its treatment begins only at the bedside, shows a deplorable ignorance of the great field of modern medicine, of which preventive medicine is an essential part. All studies in biology, but more particularly those on warm-blooded animals, directly or indirectly contribute to our information concerning disease processes. There is therefore no justification whatever for discouraging the pursuit of experimental biology in any higher institution of learning. In fact it should be strongly encouraged in order to reduce the growing burdens of the strictly medical training.

Section 2 is interpreted as permitting the inoculation of bacteria and other agents of disease. As stated above, inoculation experiments are simply the imitation of nature for the purpose of multiplying cases of disease for study. They are the starting point, and the course of discovery does not enable us to foretell what further experimentation may be necessary to attain useful results.

Section 3 places the study of experimental biology and medicine in our higher institutions of learning under the control of outspoken opponents of such study, and subjects the teachers to the supervision of untrained inspectors. The conception of what is or is not pain and its discrimination from discomfort, the use of anesthetics, the utility or non-utility of investigations — all these difficult questions are to be passed upon by the opponents of this work, and eventually by a jury.

The bill as a whole, if enacted, will probably drive out of the State the better class of teachers and investigators; or what is still more likely, it will prevent the State from drawing into it from without the best men available. It will discourage advances in the study of disease, because no conscientious man will be able to act under a law revealing so many possibilities for its transgression at any moment. It will in all probability interfere with the prep-

aration or improvement of antitoxin, as it will be difficult to obtain self-respecting, conscientious experts who will work under the conditions imposed by the bill. Many teachers and investigators have chosen their life work, with its many self-denials, with the expectation of being relieved of the many harassing conditions of business life. It can hardly be supposed that they will submit to the espionage proposed by this bill and the notoriety and publicity likely to follow such espionage — since there is nothing in the bill which would prevent the inspectors and their superiors from making use of the daily press to interpret in whatever manner they please the result of their raids upon the laboratories.

I doubt that the people of this State are prepared to stultify themselves by restricting and suppressing research at home, while freely utilizing the beneficial results and products of such work done in other States and other countries. The State which repudiates biological research should, to be consistent, forbid its officials to apply the most advanced methods for the suppression of disease.

In conclusion, I firmly believe that the human race of the future will need all the knowledge concerning health and disease which we can gather together, and that any discouragement placed upon the study of biology will prove a step backward. Wherever advancing civilization has made the domestication of plants and animals necessary to its progress, there diseases have multiplied. With the more intensive agriculture of the near future, and the denser herding together of human beings and of the animals with which they nourish themselves, it will require all the knowledge and foresight of the race to keep the present diseases in check, and to keep others from springing up out of the more favorable surroundings. Our civilization from one point of view and for the present is a great dike which protects us from an external sea of disease. There

must be no leaks in it, and those that appear must be promptly and efficiently stopped. This dike has been thrown up and guarded by the medical profession. I think it unsafe to meddle with their work and to dictate to them the methods of lookers-on. Man's power is finite enough; let us not use his weakness and failures as an argument to limit it still more.

HENRY G. BEYER

SURGEON, UNITED STATES NAVY

(Letter from H. G. Beyer, U. S. N. Doctor Beyer was present at the hearings and ready to speak in person.)[1]

U. S. S. S. Wabash, Navy Yard, Boston, Mass.

Dear Doctor, — As a naval medical officer, I should feel that I was unworthy of my position, as well as untrue to myself and the trust imposed upon me, if I did not join with you in protesting against the proposed bill for the further restriction of vivisection as a means for advancing the science of biology in all its bearings.

I should besides feel that I had joined the ranks of the most ungrateful if I failed to openly and frankly acknowledge with you the debt we all owe to the biological sciences which so constantly and copiously feed the different branches of the medical profession, and without which every important source of information and future advancement would seem to be absolutely blocked.

How could I point with pride to the reduction in the mortality returns of the navy from year to year, to the increase in the recoveries from operations as recorded in the surgeon general's reports, without at the same time giving silent thanks to whom all this is due. No one abreast with the times, and even faintly familiar with the history of the profession, would

[1] Dr. Beyer being on cruise, the proof of this letter was, with his consent, corrected by Dr. Ernst.

stop at Lister or even with Pasteur in tracing the history of its present development. It is due to the workers in general biology, to whom we owe so much. It is the physiologists, the bacteriologists, and the pathologists who have shown us the way to attain our ends in caring for our patients. How could we, moreover, willingly shut our eyes to the splendid vistas before us, and which have just been opened up to us of late, through the exploits of some of the pioneers in the biological sciences, as regards tropical diseases? Schools for the study of tropical medicine have just been opened in different parts of the world; their laboratories are for the purpose of studying the causes and treatment of some of the most hideous forms of disease that human flesh is heir to. There must be allowed the most unrestricted use of all the means which in the course of their investigation will become necessary, and we must not shut them up nor even limit them in any way. The adjective "cruel," in its relation to students of biology, must receive a new definition. The biologist gives pain to one animal in order to inform himself how best to relieve it in a thousand others. The visions of cruelty conjured up from an invisible chaos by some of the anti-vivisectionists are but fancies without any material foundation — mere auto-suggestions.

When a biologist puts to death in the most humane manner a few stray dogs or wild cats, and is animated by the desire to advance and improve thereby our knowledge of life and living beings for the betterment of the human race, he is essentially and eminently humane and not cruel.

The training which I have received in the various biological laboratories has resulted in bringing me to a much greater sense of realization of my duty and re-

lation to the dumb animals than I could have acquired in any other way. A physician thus trained to see, hear, and feel the throb and the internal machinery of life in such laboratories cannot help possessing greater knowledge and approaching his patients with keener sympathies than one who has not enjoyed such advantages. Such training alone can ever make it possible for a young physician to acquire the knowledge and experience so necessary for treating his patients successfully. His feelings of sympathy for all living things and his sense of responsibility for human life have been rendered keener rather than duller as the anti-vivisectionists would have it; he is, so far as humanity is concerned, the *moral* superior of any one not so trained. Biology refines what is most human in man.

Summing up, and looking back upon an experience of twenty-five years as a physician and surgeon in the United States Navy, I state with truth and frankness my opinion that the knowledge which I prize most and which my patients have had the best reasons for holding highest in me, is that which I have acquired from practical contact with life and living things in the various biological laboratories.

I shall ever be grateful to those who gave me the opportunity.

Very truly yours,
H. G. BEYER, M.D., PH.D., M.R.C.S.,
Surgeon, U. S. Navy.

PROFESSOR H. C. ERNST,
Harvard Medical School.

THEODORE HOUGH

ASSISTANT PROFESSOR OF BIOLOGY, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

(Present at the hearings and ready to speak.)

It is characteristic of the methods of anti-vivisection agitation that experiments upon animals are constantly spoken of as painful and cruel. The impression is thus produced upon those unfamiliar with the facts of the case that the painless experiments are few in number, and that experimentation upon animals, as a general thing, involves a large amount of suffering. I went to the hearings to give my own experience in the matter as a contribution to the facts of the case.

I have been a student of physiology since 1889, a period of eleven years. From 1889 to 1893 inclusive, I worked in the physiological laboratory of the Johns Hopkins University, Baltimore, Md. Since then I have had entire charge of the instruction in animal physiology at the Massachusetts Institute of Technology.

While at Johns Hopkins, I conducted two pieces of research involving vivisection upon warm-blooded animals; for three years I saw, and for two years assisted at practically every demonstration which was given to the students; during these years I was present at practically every student laboratory exercise in physiology — for one year as student and for two years as assistant to the instructor in charge. This student laboratory course, so far as the animals used and the general methods employed is con-

cerned, was of the same kind as that now given at the Harvard Medical School, the Institute of Technology, and the Boston University School of Medicine. While at the Johns Hopkins University, moreover, I worked in the laboratory of physiological research and know what was being done by the advanced students and instructors — being present in fact when the greater number of their experiments were performed.

As I have said, I came from Johns Hopkins to the Institute of Technology, where I have since been in charge of the physiological work. I believe I have been present at every experiment upon a living animal made in that institution since 1893. I have also attended most of the meetings of the American Physiological Society during that time, and have witnessed most of the demonstrations of the results of research work given at those meetings.

It will be seen, therefore, that my experience with physiological experimentation is somewhat more extended than that of any of the petitioners for the proposed legislation, and I have thought that it would be a contribution to the facts of the case to tell the committee how much painful experimentation I have seen during this period of eleven years.

The answer is brief enough, and no one need fear to listen to its details. The pain inflicted has been very slight indeed. I cannot recall to-day a single case of an operation upon an animal which had not been rendered insensible (either by the destruction of its brain, or by the use of anesthetics), with the following exceptions. At one time I made a series of ten or twelve experiments to test the supposed poisonous action of a drug which had been extracted from the bark of locust trees, and which it was thought might account for certain cases of poisoning among cattle which were pastured in a field where they had apparently eaten some of this bark from the young trees.

In some of the experiments, a small vein immediately under the skin was exposed by a short incision, and the drug thus directly introduced into the circulation. The pain thereby inflicted was no greater than that which accompanies blood-letting, and as the supposed poisonous drug proved to be absolutely innocuous, it may be said that none of these animals suffered more than any one of us would suffer during the healing of an ordinary cut in the finger.

I have seen some ten or twelve experiments where an operation was performed under anesthesia and the animal kept alive for some weeks, or even months, to observe the effects of the operation. I do not say that there was not some discomfort connected with the healing of the wound; but if there was, the conduct of the animals did not betray it — and I can only state my belief that not one of these animals suffered what would be called serious pain.

As to *curare*, I have often used it and seen it used; but I have yet to see an animal under its influence subjected to operative procedure, or to other conditions likely to cause pain, where consciousness was not first removed by one of the methods above described. I know that curare has been used, especially in the period prior to 1880, without the concomitant use of ether or other anesthetics; I have read papers, published since that time, which describe experiments where for some special reason the drug was thus employed, although none that I can recall were made in America. The point which I wish to make is, that despite my own extended acquaintance with physiological laboratories, I have not once seen the drug employed in this way.

In no case have I seen a demonstration for teaching purposes, where pain was possible, that the animal was not rendered unconscious in some merciful way.

To sum up: I have seen at least two hundred experi-

ments on mammals, such as dogs, cats, rabbits, and guinea pigs; I have seen at least five hundred experiments upon cold-blooded animals, especially fishes, frogs, and terrapins; and yet the number of cases where there was the slightest suffering on the part of a dumb animal (beyond the distress which accompanies the administration of ether) is certainly less than twenty-five; and even in these cases, the suffering was not greater than that which accompanies a cut with a sharp instrument, or the healing of a wound which is kept aseptically clean.

I am inclined to think that my experience is exceptional among physiologists, in that I have seen not a single experiment involving severe pain or suffering by a dumb animal. But I am sure that it is not exceptional otherwise. Other physiologists would have seen perhaps a few experiments of this character. Otherwise I believe that their experience will agree with mine.

However that may be, this may be said: If physiological experimentation involves the pain and suffering on the part of dumb animals which we might suppose to be the rule from current anti-vivisection publications, from various imaginative stories which appear from time to time in our magazines, and even from the language of counsel and petitioners for the proposed legislation, it is very remarkable that, with my opportunities for observation in so many fields in which such suffering is suspected or charged, the actual amount observed should be practically negligible; and this despite the fact that both at Johns Hopkins University and at the Massachusetts Institute of Technology it is understood that *any* experiment, painful or otherwise, is allowed in research work, provided there is a reasonable prospect of thereby discovering new truth.

EDWARD G. GARDINER

MARINE BIOLOGICAL LABORATORY,
WOOD'S HOLE, MASS.

DEAR DR. ERNST, — The committee of the legislature conducting the hearings on vivisection visited Woods Hole a few weeks since to inspect the Marine Biological Laboratory and the United States Fish Commission. It was my privilege to escort them, and to explain to them the uses of the various laboratories, and the apparatus therein.

The Marine Biological Laboratory has an annual attendance of about one hundred and fifty students and investigators. The students are largely professors, teachers, or college students who are fitting themselves to become instructors. During the thirteen years of its existence, about three hundred universities, colleges, and schools have been represented there by their professors, teachers, and students. In its various laboratories the lower forms of life, such as jelly-fish, worms, star-fish, clams, oysters, crabs, etc., and occasionally fish, are subjected to experimentation and to dissection.

The United States Fish Commission have also extensive laboratories, in which similar work is conducted by college professors and students.

In response to questions put by the chairman, I stated to the committee that if either of the two bills then before them should become an enforced law, all this work must cease, and the doors of the laboratories be closed. Further, that a great deal of the work done in the fish culture de-

partment of the Fish Commission, such as the artificial propagation of fish, by stripping the ova and spermatozoa from the living fish, would become unlawful.

Very truly yours,

EDW. G. GARDINER,

Sec'y of the Trustees.

HAROLD C. ERNST, M.D.

PROFESSOR OF BACTERIOLOGY, HARVARD MEDICAL SCHOOL

(Closing for the Remonstrants.[1])

OPENING AND INTRODUCTORY

Mr. Chairman and Gentlemen of the Committee on Probate and Chancery :

FOR the second time in a little over a year it has fallen to me to address this committee upon the subject of proposed legislation on experimentation on animals; legislation that, as we believe, is unnecessary so far as the general subject is concerned, and that is ill-considered and onerous in the case of the bills before you. Before entering upon a consideration of what has been presented to you upon the subject of these bills, two things are to be made clear: *First*, that I represent much more than the Harvard Medical School, as of course you know from the position and character of the gentlemen who have appeared here as remonstrants. *Second*, and emphatically, that none of those whom I represent — nor do I myself — appear here as favoring unrestricted experimentation upon animals, meaning by that liberty to man, woman, or child to mutilate the lower animals in any way they see fit; we resent such an imputation most strenuously.

We believe two things firmly, however — that animal experimentation is already restricted by the laws upon cruelty to animals, and by the statute prohibiting vivisection in the

[1] As delivered.

public schools, so that there is no danger of its being indiscriminately practised; we also believe that the governing bodies of the educational institutions in which it is carried on are perfectly competent to, and as a matter of fact do, exercise such control over its practice that no unnecessary or cruel work of this kind is done.

The petitioners claim that the existing laws do not cover the case, but they have never tried them to see; and this latter fact means one of two things: either very great negligence on their part in not at least trying the present laws, or else a complete absence of the evidence of the cruelty or abuses of the practice of animal experimentation, assertions in regard to which have been so freely made. If the present laws are tried and found wanting, after anything like evidence of the existence of abuses has been brought forward, we shall be found active in favoring legislation that *will* prevent these abuses, but not of the kind presented to you here to-day.

That we are not alone in believing that the present laws are sufficient to control cruelty to animals, is well expressed by the legal opinion of Judge Bumpus herewith submitted:

> " A professional engagement prevents my appearing before the committee upon the question of vivisection. Some years since, when district attorney, I had occasion to examine that statute relating to cruelty to animals to see whether it was comprehensive enough to cover such cases, and I came to the conclusion that the term employed in that statute of ' cruel mutilation ' was broader if anything than any law that might be passed which undertakes to lay down any detailed method of who may practise vivisection and how it can be done.
>
> " An examination of the contemplated statute confirms these views. Let any doctor be complained of under the present law for cruelly mutilating an animal,

while engaged in vivisection, and it then becomes a question of fact for the magistrate and jurymen as to whether cruelty has been practised. There is no doubt but that a keen sense of the humanities will always influence magistrates and jurymen to hold sharply responsible any wilful or wanton violation of the law under the name of 'vivisection.'"

Other legal authority has been mentioned in the opposite direction, but surely we are not to be governed in all parts of this case by the counsel's interpretation, first, of the bill, and then of the English law as applied to our Commonwealth, before it has ever been tried.

The ultimate aim of all this agitation is, as has been testified here, the complete abolition of experimentation upon animals, and we have yet to hear the first scientific authority quoted in favor of such a measure.

AS TO THE OPENING OF COUNSEL FOR THE BILL

Almost at the very beginning the inconsistency of the petitioners was made manifest. Counsel conceded in his opening remarks, that the practice of animal experimentation should be allowed under restriction, and that this was the opinion of by far the larger part of those persons who think about the matter; and then proceeded to place upon the stand as a majority of his witnesses, persons who acknowledged that they hoped that the proposed bill was only a step towards the complete abolition of the procedure, or at least that they were opposed to it upon moral grounds.

Counsel went on to present the names of some distinguished persons who were in favor of the bill, but from what we have heard here and elsewhere it is perfectly justifiable to assume, that of those who do not go so far as to wish to do away with the practice entirely, at any rate

most of the remainder have signed the petition for the bill under the impression that there is now no restriction upon the practice at all, or if there is, that it has at least been attempted to use the means the law now furnishes, and that these means have been found wanting.

We cannot possibly agree with the contention that this is a matter for the lay man or woman to decide without reference to the opinions of experts on the subject — it is as reasonable as to ask a plumber to mend a fractured leg with solder, or to place any other ridiculous illustration in evidence; unless, of course, Mr. Chairman, the committee are satisfied of the "defectiveness" of the remonstrants that have appeared before them.

Counsel constantly asserted that this is not an attack against Harvard College — but how can it be anything else? If not an attack against Harvard College, what do these extracts from the March "Century" mean, in a story of a French toy-spaniel, published so apropos of this hearing?

> (p. 677.) "At such moments the Massachusetts woman fell into the way of saying, under her breath, 'Harvard College shall never get you' — (p. 673.) "i ment to sell it to a Culledge i kno so help Me god i did. They cut em up to amuje the Stoodints i thort youde like to kno it — " (p. 678.) "Her first articulate words were, 'Harvard College shall *never* get you! — ' and (page 679.) 'Which would you rather do, Ariel — go to Harvard or die?' The dog promptly turned over on his back and simulated stark death."

If not an attack against Harvard College, what possible excuse was there for the reference to the Webster case — a crime of two generations ago, for which the penalty was paid to the full; a reference that when made at one of these hearings five years ago, was so promptly

rebuked by the present Speaker of the House with so severe a reprimand that even the person who made it was overcome with shame, and that would have been as severely rebuked this time, Mr. Chairman, we are confident, if you or the members of the committee had understood the allusion.

There was no excuse for that reference, sir, except that, as we have since been taught, the counsel adopted the methods of the criminal court to secure what he supposed would be an advantage for his side at any cost of respect or fair dealing.

Of the same nature was the introduction of the experiments of Dr. Wentworth, with the interpretation put upon them.

> Dr. Wentworth's experiments on lumbar puncture have been emphatically condemned by the medical profession as violations of a fundamental principle of medical ethics.
>
> "*No harm* was done to the patients by these experiments, and the demonstration of the harmlessness of the operation which they afforded has justified practitioners in resorting to it for diagnostic and therapeutic purposes; but this gain to the practice of medicine does not excuse the performance of the operation as an experiment.
>
> "Dr. Wentworth entirely agrees with the opinion here expressed, and has long regretted that his enthusiasm for the advancement of medicine led him to ignore the means by which it was to be obtained."

This happened six years ago. While explaining to the committee the differences between House Bills 855 and 856, counsel stated that section 1 of Bill 855, which was directed against human vivisection, had been omitted from Bill 856, because in his opinion *the statutes already existing*

fully covered such cases and further legislation would be superfluous. The counsel for the petitioners has thus put himself on record to the effect that the testimony introduced in regard to Dr. Wentworth — even *if it was as it was stated* — was valueless, since such practices, if carried on, were already covered by statute.

That is precisely what we believe in this matter; and at the same time I feel sure that I am justified in making the above statement in regard to the experiments, solely because they have now been brought up twice by the petitioners for this sort of legislation, and in each instance by the same persons.

Counsel also stated that Bill 856 contained section 2, — omitted in Bill 855, — exempting all inoculation experiments from Act 856. Inoculation experiments were specifically exempted, said counsel, for the reason that last year the stongest opposition to the bill then proposed was that it would affect and stop such experiments, and particularly the preparation of diphtheria antitoxin. He thought a bill stood more chance of being accepted which exempted such experiments.

Counsel thus admitted tacitly that the general opinion that such experiments were useful and valuable was so strong as not to be successfully combated. He thus tacitly admitted — against the contention of his own witnesses — that there is a general consensus of opinion in the community and among educated men: 1. That such vivisectional experiments are of value; 2. That we have the moral right to experiment on animals.

Both of these points his own witnesses (particularly Dr. Hastings, Mrs. Ward, and Mr. Hill) have been at special pains to controvert.

All evidence introduced by petitioners to show that the consensus of opinion among medical men is against such practices thus falls to the ground, since by this introduc-

tion of the clause counsel has admitted that the real opinion is all the other way.

Counsel further "assumed" that there was no claim that morphia is an anesthetic! It appears necessary to state a simple fact that is known by many persons not medical men — that an anesthetic is "a substance that produces anesthesia," and that "anesthesia is the condition of insensibility to pain"! If morphia is not an anesthetic, what sense is there in the directions given for treating an overdose of opium (or morphia), such as "shaking, forcing to walk, *flagellations*, or the electric brush, to get the arousing effects of action and pain"? — and those of us who have seen cases of morphia poisoning know that the sensibility to pain can only be aroused by vigorous applications of these methods. If morphia is not an anesthetic, what was the reason for the taking of an overdose, as in the case related in Sunday's papers (the "Sunday Herald," Boston, March 24, 1901), where the individual "could not endure the pain which carbuncles gave him," took the morphia to drive the pain away, and required five hours' hard work on the part of the attending physicians to revive him sufficiently to consider that he might recover?

Counsel stated that the burden of proof upon the petitioners would be to show:

1. That vivisection is practised. Granted; no one has denied, or would attempt to deny that vivisection — meaning animal experimentation — *is* practised within the bounds of this Commonwealth.

2. That the practice is abused. Denied; no evidence whatever, except hearsay, has been brought forward — and it is furthermore to be noted that no evidence whatever was offered by any person occupying a teaching position, and for that reason in a position to know. On the other hand the evidence of seventeen teachers and workers in

biology, physiology, and allied branches was brought forward to support the denial.

3. That there is a widespread doubt as to the usefulness to mankind of animal experimentation. Denied, so far as expert opinion goes. There *is* no such widespread doubt in the minds of persons who have given any thought or investigation to the matter. The petitioners failed entirely to present the opinion of more than one well-known person to support this contention (Lawson Tait). Those who doubt its usefulness would agree with the

4th proposition — that the practice is morally wrong, and should be done away with entirely. If the practice is morally wrong, this must rest upon the assertion that it is morally wrong to interfere in any way with the happiness of the lower animals, for their own sake or for the sake of man. If this be true, why attack the least (so far as numbers are concerned) of all the wrongs inflicted by man upon the lower animals? Why allow the slaughter daily going on for food or purposes of personal decoration — the mutilations for the sake of fashion or fancy, that count in the thousands what animal experimentation counts in the hundreds? Certainly evidence from skilled moralists has been presented here to show that it is not morally wrong. (Bishop Lawrence, Dean Hodges, Dr. De Normandie, and Rev. Mr. Magrath.)

5. The fifth proposition — begging the question of the morality of the procedure — asserted that, if the practice of animal experimentation is to be tolerated, it should be regulated by law. Granted; but it *is* regulated, by the general laws governing cruelty to animals, and by the specific law prohibiting vivisection in schools. The laws in regard to cruelty to animals cover the case fully, as has been shown the committee, by legal opinion, and as can be further shown if necessary. Counsel's *guess* at what the courts would do cannot be accepted; more especially

as the very fact of its being necessary to guess demonstrates gross negligence on the part of the petitioners, who declare they have known of the existence of cruelty and abuses all these years, and yet have made no single effort to secure the punishment of the evil-doers, under existing laws.

6. Finally, the statement was made that it would be attempted to show that the practice should not be resorted to by the inexperienced, nor employed to illustrate well-known principles — two propositions that must be treated separately. They are both denied.

Animal experimentation is *not* resorted to by the inexperienced, if by that is meant the uncontrolled. Everybody has to do any thing for the first time, once; so that in that sense the inexperienced do practise animal experimentation, but in no other.

So far as we know — and we should know if any one does — all beginners in animal experimentation are assistants first, and are trained under careful supervision before they are allowed to perform operations themselves. There is *no* unrestricted, unsupervised animal experimentation going on within our control — nor outside of it, so far as we know.

That animal experimentation should not be allowed for the purposes of illustrating known principles — in other words for teaching — is a desperate blow at the foundation of instruction. The experimental or demonstration method is the basis of the best modern teaching in all branches in which it is possible to apply it, from the kindergarten blocks to the electrician's laboratory; and it is generally recognized that such method is of the most vital importance in ordinary subjects.

Yet we are told that when we approach the most complicated problem that the human intellect attacks — the problem of life and what influences it for better or worse — we must abandon the method that has been

shown to be pre-eminently useful in all other forms of instruction, and depend upon books. How is it that books are made up, except of facts that have been established in laboratories, that have been sifted and filtered out and digested, until the good in them has been obtained and presented in the text-books? Are we never to be allowed that best of all text-books — the thing itself?

These are the points upon which counsel said the evidence offered would bear, and closed his opening by the assertion that the weight of authority, outside of the committee room and of Harvard College, is upon the side of the petitioners.

It is for the committee to decide how far this is true. The evidence submitted was practically wholly of a hearsay character or opinion. One witness made the extraordinary assertion *that a medical student pursues his studies, not to have his mind trained, but to get at facts.* Such a student might as well be a parrot!

The further assertion by the same witness that vivisection has been of no practical value to medicine, but of some to surgery, will be spoken of later. It is to be feared that this gentleman may give some trouble to the health authorities in his management of infectious diseases.

Another witness for the bill, whose knowledge of cruelty is based upon reading, but whose opposition to animal experimentation is based upon moral grounds, himself refuted the assertion that persons engaged in research become callous, by his remembrance of Dr. Holmes and the rebuke administered to the thoughtless student. Dr. Holmes had not become hardened, although he taught anatomy and physiology together for many years, but was quick to see and attend to such behavior as that of this student. Could an agent of a society for the prevention of cruelty to animals have done it more effectively or more quickly?

Other witnesses for the bill made such statements as these: one, that he "*would rather see a human being suffer than an animal*," upon which the comment has been passed that it would be well if his patients did not know of this feeling. Another stated the belief that "*not one iota of human suffering has been abated or one human life saved by vivisection*," and further, that the procedure "*is an exciting pastime*." Naturally with such beliefs, this witness's opposition to the procedure should be vigorous; and yet, when later commenting upon the operation of lumbar puncture, the same witness said she could not tell whether the removal of the cerebro-spinal fluid would cause harm, but that *more experiments were needed to settle this point* — ignorant of or ignoring the hundreds of times that the operation has been performed with no untoward symptoms whatever.

Then followed the various opinions of older men, already quoted many times at similar hearings, and an address published in the "Transcript" of the same date, and in type before read to the committee, in which the writer herself states that she has no personal knowledge of the abuses and cruelty of which she says so much.

FURTHER TESTIMONY FOR THE BILL

That individuals may change in their opinions is well shown in the quotation from Lecky ("History of European Morals," third edition, revised; D. Appleton and Co., New York, 1900, page 176):

> "The horrors of vivisection, often so wantonly, so needlessly practised, the prolonged and atrocious tortures often inflicted in order to procure some gastronomic delicacy, are so far removed from the public gaze that they exercise little influence on the character of men."

And this:

"The insidious growth of selfishness is a disease against which men should be most on their guard; but it is a grave though a common error to suppose that the unselfish instincts may be gratified without restraint. . . . The fatal vice of ill-considered benevolence is that it looks only to proximate and immediate results without considering either alternatives or distant and indirect consequences. A large and highly respectable form of benevolence is that connected with the animal world, and in England it is carried in some respects to a point which is unknown on the Continent. But what a strange form of compassion is that which long made it impossible to establish a Pasteur institution in England, obliging patients threatened with one of the most horrible diseases that can afflict mankind to go — as they are always ready to do — to Paris, in order to undergo a treatment which what is called the humane sentiment of Englishmen forbids them to receive at home! What a strange form of benevolence is that which, in a country where field sports are the habitual amusement of the higher ranks of society, denounces as criminal even the most carefully limited and supervised experiments on living animals, and would thus close the best hope of finding remedies for some of the worst forms of human suffering, the one sure method of testing the supposed remedies, which may be fatal or which may be of incalculable benefit to mankind![1] . . .

"It is melancholy to observe how often sensitive women, who object to field sports, and who denounce all experiments on living animals, will be found sup-

[1] See also Seton-Thompson in the current Century Magazine, March, 1900.

porting with perfect callousness fashions that are leading to the wholesale destruction of some of the most beautiful species of birds, and are in some cases dependent upon acts of very aggravated cruelty."

It has been interesting to follow the variations in the attitude of the petitioners, from the opening of counsel through the conduct of the case.

Almost the first statement of counsel was that the petitioners must show that there is *abuse* of the practice of vivisection, and yet witness after witness came forward and testified that he knew of no abuse existing in this Commonwealth.

Later, counsel stated that there was plenty of evidence of abuse, but that those who were dependent for their livelihood upon men like Dr. Bowditch and Dr. Ernst were *afraid* to come forward and testify.

We, in common with all other teachers, resent such a statement, and demand why, if it be true, the President and Fellows of Harvard College are not instantly notified of our intimidating methods and told that we must be removed from our places, as is easily possible for any such cause. I have had some conversation on this question with members of the second class at the Harvard Medical School, and they laugh at the statement that we could be so unjust. I assure you, Gentlemen of the Committee, that you have run some risk of an irruption of that class in this room that might have made it necessary to continue taking testimony for weeks to come.

Dr. Bigelow in his address, so often quoted, denounced vivisection in unmeasured terms, but in the paper quoted by Dr. Bowditch it is made clear that he, like ourselves, denounced brutality and cruelty, but he distinctly states (Anæsthesia: Addresses and Other Papers;" Boston, Little, Brown, and Company, 1900, page 371):

"The dissection of an animal in a state of insensibility is no more to be criticised than is the abrupt killing of it, to which no one objects. The confounding of an experiment which does not cause pain — either because the animal is under ether, or because the experiment itself is painless, like those pertaining to the action of most drugs, or because it is a trivial one and gives little suffering — has done great harm to the cause of humanity, and has placed the opponent of vivisection at a great disadvantage. A painless experiment upon an animal is unobjectionable."

Therefore counsel's assertion that Dr. Bigelow took ground against the practice *in toto* is not true.

Certain excerpts from Huxley's writings were introduced, to show that that great biologist was opposed to animal experimentation, but Huxley ("Method and Results, — Essays; New York, D. Appleton and Co., 1897, page 123) in his essay on The Progress of Science, delivered in 1887, speaks on the subject as follows:

"Unless the fanaticism of philozoic sentiment overpowers the voice of philanthropy, and the love of cats and dogs supersedes that of one's neighbor, the progress of experimental physiology and pathology will, indubitably, in course of time, place medicine and hygiene upon a rational basis. Two centuries ago England was devastated by the plague; cleanliness and common sense were enough to free us from its ravages. One century ago smallpox was almost as great a scourge; science, though working empirically, and almost in the dark, has reduced that evil to relative insignificance. At the present time science, working in the light of clear knowledge, has attacked splenic fever and has beaten it; it is attacking hydrophobia with no mean promise of success; sooner or later it

will deal in the same way with diphtheria, typhoid and scarlet fever. To one who has seen half a street swept clear of its children, or has lost his own by these horrible pestilences, passing one's offspring through the fire to Moloch seems humanity, compared with the proposal to deprive them of half their chances of health and life because of the discomfort to dogs and cats, rabbits and frogs, which may be involved in the search for means of guarding them."

Another paragraph was also quoted here to the same end — the effort to show that Huxley was in opposition to the practice of animal experimentation. ("Life and Letters;" New York, D. Appleton and Co., 1901, p. 463.) Unfortunately for our belief in the frankness of the petitioners the paragraphs which precede and follow the one quoted were omitted. They are as follows:

"I have always felt it my duty to defend those physiologists who, like Brown Séquard, by making experiments upon living animals, have added immensely not only to scientific physiology, but to the means of alleviating human suffering, against the ignorant and sometimes malicious clamor which has been raised against them."

"But personally, indeed I may say constitutionally, the performance of experiments upon living and conscious animals is extremely disagreeable to me, and I have never followed any line of investigation in which such experiments are required." [1]

"When the course of instruction in physiology here was commenced, the question of giving experimental demonstrations became a matter of anxious consideration with me. It was clear that without such demonstrations, the subject could not be properly taught. It

[1] This clause alone was quoted by the petitioners.

was no less clear from what had happened to me, when, as president of the British Association, I had defended Brown Séquard, that I might expect to meet with every description of abuse and misrepresentation if such demonstrations were given."

Much more of equal importance follows; but it will not be necessary to weary the patience of the committee upon this matter any further.

AS TO THE OPENING AGAINST THE BILL

Five years ago there was the same exhibition as has occurred in these hearings. At that time the President of the Massachusetts Society for the Prevention of Cruelty to Animals appeared in advocacy of the then bill and called upon the same vice-president of the society as appeared for the petitioners for this bill. At that time, as at this, the same gentleman appeared, and then, as now, testified that there had been no formal action of the society, nor even of the directors, in favor of the bill. It would seem to us that the activity of the society must be somewhat sluggish if it takes so long as this to get at an expression of its opinion.

A series of statistics were presented here purporting to give the expression of opinion of many physicians in this vicinity in regard to animal experimentation. As was brought out during the hearing, the circular letter addressed to the physicians had at least one name on it that was put there without asking the permission of the owner — who wrote a letter to certify that he stood on the matter of animal experimentation as do Dr. Bowditch and myself. Furthermore the addressed envelopes were not opened by the person to whom they were addressed, so that the statistics collected were tabulated by an interested person. Finally, the circular letter and its replies could not, in any

case, be considered as a petition for this bill, for nothing is said about any bill in it.

The questions sent out were not to be answered so as to show the position of many men who support us in our contention in this matter and to my personal knowledge were not answered at all by many who take a vital interest in the question — for the very reason that they felt that any answer they could make would be liable to misinterpretation.

The results, as given, were that six hundred and thirty-eight answers were received out of one thousand, six hundred and fifteen requests for information sent out. They were tabulated as follows: eighty-five opposed to all vivisection; one hundred and thirty-four favorable to it, restricted by law, if without pain; two hundred and forty-six favorable to it, restricted by law, if for new and useful discovery; sixty-one thought it might be tolerated; and one hundred and twelve favored unrestricted vivisection. So that it appears that five hundred and fifty-three out of six hundred and thirty-eight physicians would permit the practice in some form — and yet the object of the petitioners is the complete abolition of the practice, as has been testified here many times.

In closing his case, counsel for the petitioners read many extracts from the opinions of Sir Thomas Watson, Surgeon General Sir Charles Gordon, Dr. Charles Bell Taylor, Dr. F. S. Arnold, and Dr. Edward —— (name not understood); but these were not read from the original sources, but as quotations from a leaflet, "Medical opinions on Vivisection," published by the New England Anti-vivisection Society, and with no possibility of verifying the statements. This we object to as vigorously and with as good reason as does Dr. Keene in his letter (submitted herewith), and as may be illustrated by the instance of the alleged advertisement for one thousand cats said to have been issued earlier in the year by Harvard College. I

have been trying ever since that statement appeared to find the original advertisement, but without success in getting any definite knowledge in the matter until I chanced to run across this extract in the "Animal Defender" for January 1901:

> "*Harvard's Cats.* We see that Harvard College has lately advertised for one thousand cats, offering to pay from twenty-five to fifty cents apiece for them. The responsibility for this, we understand, rests with Professor Shaler, who is the head of the Lawrence Scientific School; and many owners of pet cats in Cambridge and adjoining towns are naturally indignant, and talk of a public protest against such methods. Such advertising is, of course, an encouragement of theft, lawlessness, and cruelty, and many an owner of a fine pet cat will mourn, and has already mourned, its loss in consequence. The *Transcript* of December 6 says that Judge Almy, on December 5, 'severely criticised the practice by boys of disposing of cats to the Jefferson Physical Laboratory.' The Judge should strike higher in his criticism."
>
> "By the way, we see in the papers that this Professor Shaler, on December 17, in Sanders Theatre, Cambridge, strongly defended the institution of slavery as once existing in this country."

If truth in this matter had been desired, it would have been as easy for the editor of that publication to secure it as it was for me. A letter of inquiry to Professor Shaler brought out the following reply (in part):

> LAWRENCE SCIENTIFIC SCHOOL,
> CAMBRIDGE, MASS., March 7, 1901.
>
> MY DEAR DR. ERNST, — That statement about a thousand cats is preposterous. . . . I have sought everywhere and find that no cats were ever advertised for.
>
> Very truly yours, N. S. SHALER.

EXPLANATORY OF PAIN

The exact definition of pain is as follows: Pain, — uneasiness or distress of body or mind; bodily or mental suffering. (*a*) That property of sensations or states of consciousness which induces in the sentient being an effort or a desire to suppress or be rid of them: the opposite of *pleasure*. Pain may have any degree of intensity, from the least perceivable to a maximum at, or about, which consciousness is destroyed. It may be local or general, physical or mental, or both together. In many sensations, as in those produced by burns, the prick of a pin, or a colic, the element of pain is so predominant that such sensations are distinctively called *pains*. (Century Dictionary.)

With such a definition, who is to decide what is or is not pain? For a clearer idea of the differences of pain in man and the lower animals, the following may be of interest:

WHAT IS PAIN?

(Physiological Cruelty; or, Fact *v.* Fancy. An Inquiry into the Vivisection Question. By Philanthropos. London: Tinsley Bros., 8, Catherine Street, Strand, 1883.)

(page 4.) "All that we know about Pain is derived from human experience. This seems very obvious, but not the less it is often forgotten. As a matter of fact, we KNOW nothing about any pain except what we have ourselves suffered. We cannot feel with another person's nerves; and when he describes his feelings, we cannot be sure that the words he uses bear the same meaning to him as they do to us; but we take for granted a general analogy between him and ourselves, based on our common nature; and from time to time we correct this assumption, as we discover minor differences between us, and conclude,

perhaps, that he feels pain more or less acutely than we do. As men have been acting on this assumption for centuries, and constantly comparing experiences, there has grown up an average standard of human sensibility, by which we guide ourselves, and which allows us to say in a rough way that such and such a person is insensitive or hypersensitive. But when we have to do with animals we lose ourselves at once. The community of nature, from which we argued with men, has sunk from an identity of species to a similarity of type; the comparison of experiences by which we corrected our conclusions is impossible. We have nothing left to guide us except an analogy with ourselves, which we know must be misleading, and 'signs of pain,' which are of all indications the vaguest. They are thus vague, because all that they prove is that something is going on which the organism repels; but they do not prove that there is any consciousness of it, and if there is consciousness they do not show the degree of feeling. This will be clearer if we glance at what actually happens when an injury of any kind is inflicted.

(page 10.) "There may be all the signs of pain which result from the general sensitiveness of the nervous system; but these prove that it is sensitive, and nothing more; they prove nothing about Feeling, of which we know them to be quite independent. And, observe, when it is said that a pithed frog (*i. e.*, one whose spinal marrow has been cut through, near its junction with the brain), a pigeon without cerebral hemispheres, or a chloroformed cat cannot feel, the statement is not a conjecture. We are on firm ground, because we are going upon human experience, assisted by trustworthy analogy. We have the evidence of men and women who can be questioned, and can tell us

what they have felt and not felt. We know that we cannot feel without our brains, and we find that whenever we can test the functions of the brains of other animals, they are like ours in kind though differing in degree. We see also that the general type of the nervous system is the same in all vertebrate animals, and that its increasing specialization, as we ascend the scale, is all in the direction of resemblance to our own. We have, therefore, every reason to believe that the brain is always the organ of consciousness, and that when it is absent, or inactive, there can be no consciousness, and consequently no feeling.

"As the existence of feeling depends upon the activity of the brain, there is a fair presumption beforehand that it also increases with the more perfect development of that organ; and we should naturally expect to find that animals can both enjoy and suffer more, as they stand higher upon the ladder of being, and that man — the highest of animals — is also chief in sensibility. We can never get inside the consciousness of a creature with which we cannot communicate; but in the human race we find a certain rough proportion between sensibility and intellectual development, which leads us to believe in a similar proportion existing in the ranks below us. Savages will undergo with equanimity tortures which no civilized man (except perhaps under great excitement) could endure; and it is impossible to believe that the prolonged pain of tattooing could be borne for the sake of ornament by any one who felt it as we should do.

(page 14.) "Among human creatures we see the effect of mental development upon the sense of pain very clearly in the case of children. An infant can be vaccinated without making it cry, if its mind be

kept occupied by a bit of sugar held before it; and it will undergo even much more pain without discomposure, if well amused. But when that child is three or four years older, he will understand that something is going to be done to him; he will be terrified at the preparations; neither sugar nor anything else will divert his mind; and he will be conscious of all the pain given, and probably exaggerate it from terror. If pain can thus be a secondary thought in the minds of infants, it can be still more so in that of animals.

"A house-dog met with an accident, by which a large piece of the skin and flesh above the eyebrow was cut and hung loose over the eye. His master (a surgeon, who furnishes the anecdote) determined to stitch it. Now, it is well known that — the skin being extremely sensitive — stitching is one of the most painful parts even of serious operations. The dog was taken into a shed, muzzled for the safety of the operator, and the cut stitched up. All the time that it was being done, he was straining and struggling to get away, though never whining nor crying. The instant he was released, he dashed into a corner of the shed, and seized a bone which he had had his eye upon, and which had possessed his soul while he had been undergoing operation without anesthetics, and proceeded to enjoy it.

"A horse, whose leg was badly broken, was sentenced to be shot, but there was considerable delay before the execution could take place. The bones were completely broken through, so that the leg hung loose, a state of things during which the least motion causes a human patient most exquisite agony. No suffering is worse than that from a broken bone, and the only way to prevent its becoming intolerable is to avoid the slightest jar which can grate the fragments

against each other or the surrounding flesh. But during the two hours between its injury and its death this horse grazed, AND LIMPED ABOUT TO GRAZE, carrying the fractured limb dangling.

"Such cases as these leave it no longer to conjecture whether animals feel as keenly as we do. We knew beforehand that they were not likely to do so, on account of their lower mental caliber, implying an inferior supply of nervous energy, and also on account of the absence of the mental element in their sufferings; we saw that their REACTIONS (commonly called 'signs of pain') proved only irritability, and not feeling; and here is absolute demonstration of the truth of our inferences.

(page 19.) "We have now seen that the Feeling of Pain is dependent upon Consciousness, and, in a certain degree, proportionate to Intellect; consequently, an animal at any time suffers less than a man would do from the same cause; and under anesthetics (like man) does not suffer at all. Injuries to the brain are painless to men, and must, therefore, be painless to animals. Prolonged and deep operations are not more painful to men than superficial ones (since the cutting of the skin is the acutely painful phase of any operation), and therefore they cannot be so to animals; and we have moreover seen from facts, that what would cause us agony hardly disturbs their equanimity. Convalescence after operations is normally painless to both. All these facts must be borne in mind in further discussing the question of experiment upon living Animals."

AS TO THE PRESENT LAW

I want to call the attention of the committee to the present provision of the law, for if it is proposed to alter the

law, it is pretty important to know what the law is now. We have [1] a law against cruelty:

> "Whoever overloads, overdrives or overworks, or deprives of necessary sustenance, or cruelly beats *or mutilates*[2] an animal, or procures this to be done to any animal; or having charge or being in custody of any animal, inflicts unnecessary cruelty upon it, etc., is punishable by imprisonment in a jail for a period not exceeding one year, or by a fine not exceeding two hundred and fifty dollars, or both." [A punishment more severe than expressed in the bill before you.]

"A corporation which violates this provision is punishable by fine and is responsible for the knowledge and acts of its agents or servants. Officers are authorized to arrest, without a warrant, persons who are suspected of being guilty of this act, and, finally, there is a most stringent and unusual provision to the effect that when a complaint is made to a court or magistrate, and when the complainant believes, and has reasonable cause for believing, that this law is being violated in any particular building or place, and the magistrate or court is satisfied that there is reasonable cause, he may issue a search warrant to search the building. There is, therefore, in Massachusetts a law, applicable to vivisection, of the most extreme kind, which would enable any person who could satisfy a court that he has reasonable cause to suspect that cruelty was being practised in a Massachusetts medical school, or elsewhere, to procure a search warrant to search the premises and discover the animal and the parties cruelly treating it, and to cause the arrest without a warrant of the persons who are suspected of practising the cruelty. There is also a later act, passed in 1894, which absolutely prohibits the

[1] Public Statutes, Chap. 207, paragraph 52.
[2] Italics mine.

practice of vivisection in all public schools in this Commonwealth, and prohibits the exhibition of the body of an animal on which vivisection has been practised."[1]

DISCUSSION OF THE PROPOSED LAW

Counsel stated that these laws (House Bills 855 and 856) are proposed to do for this Commonwealth what the English law has done for England — distinguish the rights of the lower animals against the material interests of man; and one of the committee asked Professor Sedgwick if the English law was a success or not. Professor Sedgwick answered, "No;" and a further reply is furnished to the question of the committee, as well as a comment upon the intention of the petitioners, by the following communication from one of the most active anti-vivisection agitators in England, under date of London, January 15, 1901:

> "Nor will cruelty alone be the vice to invade us. It has a brother demon whose name is lust, which will assuredly raise its hideous head as soon as the old moral barriers are thrown down. Even now in more ways than one it is becoming evident that the principles and practice of vivisection and of sexual immorality have a mysterious connection; and that if mercy be struck out of the calendar of human virtues, purity will assuredly go along with it. Then, instead of Christ's 'kingdom of heaven,' in which the 'merciful shall be the blessed,' and the pure in heart shall 'see God,' the coming age will witness the setting up of a reasoned, scientific, Neo-Paganism worse and more foul than any old idolatry of Melkarth or Astarte. . . .
>
> "Even so, I believe that the divine voice of conscience will finally vindicate its right to rule supreme over all the claims of selfishness and passion; and that

[1] J. B. Warner, Esq.

the God-inspired impulse of fresh sympathy for the humbler creatures of the woods and fields, which is now stirring in thousands of hearts in Europe and America, will not be suffered to die out under the blight of the miserable doctrines which have their natural outcome in vice and vivisection." [1]

Comment, it seems to us, is unnecessary.

AS TO THE PRESENT BILL

Coming to the bill itself, — and I have confined myself to Bill 856, in accordance with the statement of counsel that the two were combined in this one: —

AN ACT

To regulate the Practice of Vivisection.

Be it enacted by the Senate and House of Representatives in General Court assembled, and by the authority of the same, as follows:

SECTION 1. No person shall perform on any animal any experiment calculated to give pain to such animal, except subject to the restrictions hereby imposed, namely: —

(*a*) Such experiment shall be performed only for the purpose of discovering or demonstrating unknown or uncertain physiological or pathological phenomena, the knowledge of which will be useful in saving or prolonging human life, or alleviating human suffering.

We object to this section because, —

First, it is indefinite in the use of the words "calculated to give pain." These may be interpreted as meaning

[1] Frances Power Cobbe. Quoted in Boston Transcript, January 30, 1901.

intended to give pain, implying that the operation must be performed with malice; or, they may be interpreted as meaning experiments that *will* give pain. In this case the extreme difficulty of knowing what the signs of pain are in any given instance would stand in the way of a true interpretation of the phenomena seen — and certainly such an interpretation cannot be left to unskilled agents.

Second, we object to paragraph *a*, because it is intended, as counsel informed us, to do away with any animal experimentation whatever, painful or painless, for purposes of teaching or demonstration — and this we hold to be an unjustifiable limitation of teaching in medicine, or in biology in general. In the second place, it practically prevents any experimentation whatever; for of very few series of experiments can it be said beforehand that they will surely be useful in saving or prolonging human life or alleviating human suffering.

It can only be said that it is with these objects in view that they are undertaken; what the result will be, the result only can show, and few experimenters would care to take the risks involved if this section should become a law.

It practically calls a halt, and says legally, what one of the petitioners has already said in terms, that we have learned all we are to be allowed to learn, and must be content in the future with what we know now.

Surely this cannot be the meaning of the majority, even of those who support this bill.

(*b*) Such experiment shall be performed only by a graduate in medicine of a legally chartered college or university hauing the power to confer degrees in medicine, and in a building and in a part thereof which has been previously registered with the secretary of the Commonwealth by a

person or corporation having control thereof, for the practice of vivisection. Such registration shall be made and a certificate thereof issued in such manner as the secretary of the Commonwealth may, from time to time, by any special or general order, direct: *provided*, that every legally chartered college or university in this Commonwealth having power to confer degrees in medicine shall be entitled to a registration under this act.

We object to paragraph *b*, because it exercises what appears to us to be an unjust discrimination, and shuts out at once from any research in biology those who do not possess a degree in medicine.

As has been shown to you, this would effectually dispose of such work as has been done by Professor Sedgwick and many of the gentlemen associated with him at the Massachusetts Institute of Technology, and of other biologists throughout the Commonwealth; it would put an end to such a place of study and research as the Wood's Hole Biological Laboratory; and it would have, if in force, arrested all that brilliant series of researches of Pasteur, that add so much to the sum of human knowledge and take so much from the suffering of mankind.

As a specific case in point, this section would prevent the performance of the experimental diagnosis of rabies, officially carried on in my laboratory by a gentleman thoroughly competent, but not a graduate in medicine. It would also seriously cripple the work of the laboratories of the Massachusetts General and of the Boston City Hospitals in this city, and of others elsewhere, in the experimental diagnosis of disease — work often carried on by non-graduates in medicine, but never by incompetent persons.

Of course the misspelling in line 13 is trivial, but the

attempt to limit the place of experimentation is not. It often happens that the place for carrying on an experiment must be changed from one part of a building to another, or from one place to another, and that quickly.

Finally, such great institutions as the Massachusetts Institute of Technology are prohibited from obtaining a license at all.

(*c*) No persons except graduates of a legally chartered college or university, having power to confer degrees in medicine, and such assistants who shall not be students of medicine, as are actually necessary, shall be present at such experiment or allowed to witness the same; but nothing herein contained shall be construed to prevent any of the agents described in section three of this act from being present at and witnessing the whole or any part of such experiment.

Paragraph *c* leaves a door open — probably not intended by the petitioners. We believe it was intended to exclude students of medicine from being present at any animal experiment, but by its wording it does not do so; for, provided that they hold *any* degree from a chartered college or university — having also the power to confer degrees in medicine — they may be present in any numbers and as often as they please, and as the operator may allow.

In other words, any graduate of any department of Harvard College — not alone of the Medical School — may be present at such experiments, while no graduate of the Massachusetts Institute of Technology, no matter how eminent, may have the same privilege.

On the other hand, an agent of any society for the prevention of cruelty to animals — of such caliber as the offi-

cer of the Massachusetts Society testified they were likely to be — may enter at any time, with the privilege of interpreting the experiments as he sees fit.

Of course the further objection holds, that this discriminates, and allows some of our students to be present at operations and others not, placing legal restrictions upon the facilities which we are permitted to offer to a portion of our students.

(*d*) The animal shall, before the beginning and thenceforth during the whole course of such experiment, be sufficiently under the influence of a general anæsthetic to prevent the animal from feeling pain. The substance known as urari or curare shall not, for the purposes of this act, be deemed an anæsthetic.

Paragraph *d* is, as it appears to us, as unwarranted as the others. It requires the use of a *general* anesthetic at all times, and by that very fact may require the infliction of unnecessary suffering. For it is well known that general anesthetics, like ether or chloroform, are not at all times necessary; that local anesthetics, like cocaine or the application of cold, may easily be all that is necessary for preventing the perception of pain, and the recovery from their use is surely attended with much less discomfort than from the general anesthetics. Merely a mention need be made of the fact that the paragraph prevents any attempt at the discovery of new anesthetics, and announces that the world's progress in this direction must stop.

As to *curare* the wording prohibits an attempt to verify the evidence adduced to show that after all it may be a true anesthetic, and that therefore the feeling against its use has been unduly aroused.

(*e*) Every animal subjected to any such experiment shall be killed immediately upon the conclusion thereof and while under the influence of the anæsthetic.

Paragraph *e* is most sweeping in its mandate, and prohibits absolutely all classes of experiments that need time for their completion and the study of their results. The experiments upon the larynx (of Dr. Walton) furnish a case in point. If they had not been done it would have been impossible to apply their results to operations tending to save the lives of persons with malignant or other disease of the larynx — as has been done, and as has been shown by testimony offered to you.

SECTION 2. The inoculation of or administration of drugs to any animal for any medical or scientific purpose, by any graduate described in section one hereof, shall not by itself be deemed an experiment to which the restrictions of said section apply.

Section 2, if we accept the interpretation of counsel, and if I am correct in stating that interpretation, exempts from the restrictions of the bill such experiments upon animals as are in the line of bacteriology.

In the first place we cannot accept counsel's interpretation of what is intended by this bill, any more than, as has been seen, can we accept his interpretation of much that has been said by the remonstrants.

Nor can we accept modifications in the way of punctuation that may have suggested themselves as the hearings have gone on.

Of course the experience of the legislature with the vagrant semicolon[1] is too recent to make necessary anything but a reference to that illustration.

[1] In liquor law.

But, accepting counsel's interpretation of the intention of the bill, we, who know the details of the work in bacteriology, know that that work would be seriously interfered with by the passage of this bill, and in spite of the presence of this section.

Take, for example, such an experiment as that upon the effect of light on tuberculosis of the skin, which the gentlemen of the committee saw on their visit to the Harvard Medical School.

The animal shown to you is only one of a series that have been or that it is proposed to study. Skin tuberculosis is only one locality of one disease that it is intended to use.

To get any satisfactory idea of the action of light it will be necessary to use some of the most active forms of infectious material, and to watch their effects for perhaps a long time.

Yet the introduction of this material may be impossible by simple subcutaneous injection — it may be necessary to operate. If it should be necessary, anesthetics would be employed; but it would be useless to perform the operation if the animal had to be killed before coming out of the anesthesia, for the results should be watched for a long time.

Furthermore, in the particular case called to your attention, the immediate conduct of the experiments is by a non-graduate in medicine — a student, who has not yet completed his medical studies.

This is but one instance; and an almost interminable series could be brought before you, to show that bacteriological experiments are not to be classed by themselves without absolute injustice; that they are as essentially experiments upon animals as are those of physiology, or any other branch of biological investigation; that they may and often do require operative procedures upon living

animals; and that the details are often in the hands of non-medical but competent assistants.

The practical application of the results of the study of the bacteria is so widespread and has been of so much visible importance, that the equal importance of the studies upon which it is built up, and of which it is but one of the blossoms, has been lost sight of; and the sturdy trunk of knowledge on one of the many branches of which this blossom flowers, is obscured by the very luxuriance of its own growth.

SECTION 3. The authorized agents of any society for the prevention of cruelty to animals incorporated under the laws of this Commonwealth shall be permitted to enter any place registered as required by section one hereof, at any time, without previous notice, and to take the name and residence of any person found therein.

Section 3 is objectionable of course. It is impossible to see how we could be expected not to remonstrate against being subjected to the supervision of such agents as the Massachusetts Society for the Prevention of Cruelty to Animals employ — ex-policeman or "any other good man" they can get.

Is it probable that the reports of such persons would be of an understanding nature, or that the agents of any new society would be any more competent to apply the law?

SECTION 4. Any person who performs, or assists in performing, any experiment described in section one hereof, in violation of either of the restrictions thereby imposed, or excludes or assists in excluding any agent described in section three hereof from any place described in said section,

or being in such a place refuses to disclose his true name and residence to any such agent, or violates any other provision of this act, shall be punished by fine not exceeding three hundred dollars.

If the preceding sections of the law be enacted, this one is immaterial, for the *amount* of the punishment makes very little difference.

We object to the threat of punishment as embodied in the law itself.

We believe that in many instances, as has certainly been the case in some, supporters of restrictive legislation in this direction do so in the belief that there is no restriction already existing.

This we assert is not the case, and we cannot consent to any further legislation until that now on the statute books has been tried and found ineffective.

In such event, we will be found as active in supporting proper restrictive measures as we are now in opposing such legislation as this before you.

We do not believe in unrestricted or cruel experimentation upon animals made by any one who may desire, but we do most emphatically believe in the freedom of research and the freedom of teaching.

AS TO THE TESTIMONY AGAINST THE BILL

Counsel for the petitioners claimed that the remonstrants offered cumulative testimony. If he meant that it was overwhelming testimony it was well; if he meant that it was unnecessary, let us see how that could be.

The statement was made that the petitioners had to fight an oligarchy — a medical oligarchy.

We believe the word was used without a full sense of its meaning — "a form of supreme government by a select few," or "the class who control such a government" — and it was certainly meant as a term of reproach.

In any case it is only necessary to call to your minds the gentlemen who have testified here, or who have been ready to do so — representatives of the governing or teaching bodies of Tufts College, Boston University, Clark University, The Massachusetts Institute of Technology, The Wood's Hole Biological Laboratory, Wellesley College, Harvard College — the teaching and the preaching clergy — the medical and surgical professions at large.

Any one who would consider all these interests to be a *small* body, or an exclusive class exercising supreme power, must be sadly deficient in the perceptive qualities.

It has also been stated that this is not an attack against Harvard College, of which I have already said something. Suppose that it is not, we are sure that the college authorities would resent being left out in any such movement against education and research in which they are so deeply interested.

Suppose, moreover, that the intention was as stated, and that some other institution or institutions were the ones against which this bill is directed, without specification. It would, of course, be necessary to produce testimony from so many that are interested in the line of animal experimentation that there could be no doubt what the general feeling is in regard to such restrictive legislation; and this we believe we have done.

Still further, because the petitioners declared that it was their intention, by means of this bill, to stop all teaching by demonstration upon living tissue, whether painful or not, the burden was placed upon the remonstrants, that they should show, not only how disastrous such limitations would be in the opinion of experts engaged in biological

teaching, but also in the opinion of educators in other lines of work, and in the opinion of those engaged in applying the results of laboratory experimentation to every-day practice.

This also we believe we have done, without unnecessarily taking up the time of the committee, and at the same time with not nearly the amount of detail that might easily have been brought out. We rested our case with at least five experts in different lines of investigation in the room and ready to testify — not after being obliged to call upon unanswering names.

Our effort was to show the committee such varying lines of weighty opinion that they could not feel that this bill is opposed by men of one or very closely allied interests only, even though some of those interests are so intimately concerned with the human race as the care of the sick.

This being so, it lies with the committee, not with counsel, to determine whether or no the evidence has been cumulative or unnecessary. Our effort from the beginning has been to expedite matters, and to lay the facts in the case plainly in evidence, not to obscure statements of fact or expert opinion by the methods of the criminal courts.

GENERAL

We heard with interest counsel's declaration that before he got through he would show that no advance or new discovery had been made within the generation of those now working, and we heard with the same amazement as in times past the assertions that no good in the knowledge of disease has come from these experiments, or "that more harm than good has come from them." The only possible explanation for such assertions is an ignorance of or an incapacity for appreciating the facts.

Some of these facts I will endeavor to give you.

I lay much stress upon my own line of work, because of course I am more familiar with that than with any other; but, as I have stated, this line of work is dependent upon animal experimentation from beginning to end, not only in itself, but as drawing upon the results of the same line of work in other lines of investigation.

The changes in medical knowledge have been many and of vast importance, and it would seem, if our just hopes are gratified, that more important changes are still to come.

Necessarily, since the discovery of ether, no event has so profoundly influenced medical practice and teaching as the realization by the medical profession of the tremendous importance of the theory of bacterial infection. Ether itself would not have proved the blessing it has, if the knowledge of surgical fever, of septicemia, pyemia, and similar processes had not been made as clear as has been the case. Of course the knowledge of bacterial infection does not in any sense cover the whole field of medical advance, but it is of itself one of the great steps of the century in medicine, and much of our exact knowledge of etiology is dependent upon it.

It is the general knowledge of etiology and public hygiene that has most benefited by the increase in our knowledge of the bacteria, and this increase in knowledge has been dependent upon the destruction of the old theory of spontaneous generation. Until this could be definitely done away with, it was not possible to secure much support for a belief in the assertions as regarded the specific nature of the bacteria.

Through this theory of the action of the bacteria in the production of disease, we have gained a practical working knowledge that is of incalculable value in the management of these processes, even though our hopes of securing a specific means of treatment have not yet reached their full fruition. What better illustration of this can be given than

the absolute disappearance of hospital gangrene or of puerperal fever from the hospitals in which these diseases used to be a curse to the attendants and a frightful menace to the patients? Neither of them were the object of *specific* treatment, in the sense in which we understand the word now; in neither of them has any "antitoxin" been worked out; in fact, as to puerperal fever, it is well known that more than one bacterium may take part in its production. But in both, the gospel of cleanliness according to bacteriological methods has done its work thoroughly, and these diseases have disappeared as a menace to sufferers liable to their attacks because of our knowledge of the bacteria and their methods of action. Cleanliness as it was formerly understood was thoroughly applied, but it was ineffective as compared with the results of to-day, because there was then no conception of what to guard against. It is ridiculous to claim, as a well-known English surgeon has done, that his very excellent results in abdominal surgery were due to common sense and cleanliness, and not to the knowledge of the bacteria, based upon all the experimentation of recent years. This is the very greatest result of this work, the plainest deduction of all — that properly applied cleanliness — meaning the exclusion of pathogenic bacteria from wounds — makes it possible for any surgical procedure to be carried out, with absolute certainty that no unfortunate results will follow, so far as surgical fevers are concerned. And what a field has been opened to the surgeon by this fact! Operative interference of all sorts is justifiable now, and is daily carried out, as was never the case before; operations are now performed often that were hardly dreamed of not many years ago, and if performed, were carried out as a desperate and last resort for the sake of the life of the patient.

This is mainly due, not to the knowledge that cleanliness is important, but to the knowledge of what cleanliness

means, and how it is best secured. Indeed, so brilliant are the results in surgery, and with such comparative ease have they been obtained, that the more complex problems still to be solved in the domain of clinical medicine have been somewhat neglected because the results seen in them have not been as brilliant. For although it is true that the only specific of wide applicability in human diseases is the antitoxin of diphtheria, the solving of this problem alone is an achievement of the most wonderful nature.

For the rest, the management of other infectious diseases may be intelligently conducted as never before; and if our knowledge be properly applied, the spread of these scourges may be largely arrested, if not prevented entirely.

These results have not been reached without many failures, mistaken inferences, and stumblings on the path toward the truth — and yet we are told we must be content with what we now know.

It cannot be doubted that finally we shall reach the goal toward which they all tend, of securing a means for the arrest of the processes when once begun; but in the meantime our present knowledge is too valuable not to be applied to its fullest extent, and as in pulmonary tuberculosis and typhoid fever, so it is our duty in pneumonia, cholera, tetanus, and other diseases in which we know the specific cause and its site, to carefully apply our bacteriological knowledge in their diagnosis and management, as the studies in the laboratory make this knowledge clear. In the former domain of medicine — that of diagnosis — it is hardly necessary to more than call to your attention the means for diagnosis dependent upon knowledge of the bacteria that have been perfected within the last few years. Every one of them is of the utmost value, either for life-saving or protective purposes. Tuberculosis, diphtheria, typhoid fever, glanders, anthrax, actinomycosis, gonorrhea, dysentery, and so on, can not only be discovered with much

greater accuracy, but can be treated with much greater intelligence and precision than before. Lest the list given above seem meagre in numbers, other of the diseases less common in this vicinity should be mentioned; for they are as important in themselves as any, and all serve to show the wonderful activity in medical investigation of the last generation, and the marvellous fruits that are the results of that investigation. Tetanus and rabies, malignant edema, cholera, some few of us know from personal contact with them; and the same may be said of bubonic plague, Malta fever, Madura foot. Leprosy, the scourge of localities infected by it; malaria, brought to our special knowledge by the sufferings of many of those returning from the Spanish War; influenza, that has apparently become permanently resident among us; and pneumonia, always with us, — have each and every one become better understood and better amenable to treatment, by reason of the improved knowledge of their causation, methods of diagnosis or treatment, directly due to the study of the microorganisms and animal experimentation.

So too have the studies upon the bacterial flora of the intestines, first begun in this vicinity by the late Dr. John Jeffries in my laboratory, been productive of enormous benefit in the way of feeding, and the beginning of an understanding of the processes of intestinal digestion. The first baby I ever heard of as being fed upon sterilized milk, and as I believe the first one ever so treated, was a patient of mine, and the idea of sterilizing the baby's milk came as a direct result of laboratory knowledge.

I should weary you if I should go on to speak further of the application of the knowledge of the bacteria and of fermentative processes to the matters of general hygiene and to commercial purposes. The disposal of sewage by bacterial action in filter beds, the brewing of beer with pure cultures of yeasts or the possibility that yeasts may be the

cause of cancer, the ripening of butter, and the fermentation of wines by special cultures, are all matters of common occurrence illustrative of what I mean.

A review of the ways in which it has been sought to secure a specific treatment for the infectious diseases may, however, prove interesting and instructive, and may serve to show how disastrous it would be to depend upon present book knowledge. The inference to be drawn is, apparently, that each process is a problem by itself, and must be worked out for itself, by the combined efforts of every one competent to do so.

First, there is vaccination against smallpox; this is really the substituting of a mild type of disease (cow-pox) for a malignant form of a similar but different disease, without reference being had to the actual causative agent in either.

Then came the efforts of Pasteur to secure protection against anthrax, based upon the fact shown in the laboratory, that cultures of the bacillus of this disease could be *attenuated* in virulence, upon being subjected to certain abnormal conditions; and that when thus *attenuated* they merely made the animal sick, but did not kill after being inoculated: when the animal had recovered, it was found to be in a condition to resist the action of cultures in full virulence. In other words, here was a method of protection against a malignant form of disease by subjecting the patient to an attack of a mild form of *the same disease* (not a different disease, as seen in *vaccination*). This successful production of immunity by an attenuated virus led to many efforts in the same direction, without great success thus far in diseases attacking man, except in rabies. And here the result is somewhat different, for we do not in this case deal with the actual specific cause alone, but with an emulsion of the tissue in which this cause is known to be present.

Then came tuberculin and mallein, both dealing with the intracellular products of growth of the specific causes

of the disease, as seen in the test-tube, for both tuberculin and mallein are prepared by making glycerin-extracts of the bodies of the bacteria grown in pure culture. Their use is, therefore, an example of the employment of the chemical products of the bodies of the bacteria, and not the vital activity of the bacteria, as a means for fighting the diseases against which they are directed.

Finally we have the antitoxins of tetanus and diphtheria, the former not so successful clinically as was hoped, because the disease is so slow in becoming clearly defined that treatment is too long delayed; the latter, the final triumph of the scientific method of laboratory study as applied to the actual treatment of disease. How this triumph has been carried out to its extreme in our own community the statistics of the South Department of the Boston City Hospital will tell more eloquently than any words of mine could possibly do.

So far as it is possible in a statement here to allay any disturbance in regard to the diphtheria antitoxin that may have arisen from the recent reports in regard to the occurrence of tetanus after the use of this material, I desire to do so.

The antitoxin of diphtheria is contained in the blood-serum of a horse that has been immunized to the toxin of the diphtheria bacillus. When properly prepared and cared for there is absolutely no danger from its use, and no untoward results have ever been shown to occur under such conditions. It is true that such results have been said to occur, but upon investigation they have invariably been shown to be due to faulty preparation or administration of the material.

Therefore, if it should turn out that the newspaper reports of the occurrence of tetanus in patients upon whom the antitoxin of diphtheria had been used are true, it will as certainly turn out, if all the facts can be reached,

that that antitoxin was negligently prepared or carelessly used.

The antitoxin is necessarily a very unstable material, being made up largely of blood-serum, an albuminous substance that is easily subject to putrescent changes, and unless properly taken care of may become dangerous. It has happened to me personally, when I had charge of its production for the City of Boston, to prevent the use of the substance when it had already become decomposed, the proposition to use it coming from a physician who would resent any reflection that she was and is not as competent to judge of the application of new remedies as the most expert.

Before leaving this part of the subject, it may be well to give in concise form to the committee the list of diseases due to the bacteria in which it may be necessary to employ experiment upon animals for purposes of diagnosis, in each case the procedure being necessary for the proper diagnosis and treatment of the disease. As they are mentioned in the text-book which I use for my students they are: the pyogenic bacteria (those which produce abscesses and the varying forms of suppuration), the tubercle bacillus (the cause of consumption), the glanders bacillus, the fungus of actinomycosis, the anthrax bacillus (in man the disease is called malignant pustule), diphtheria, tetanus (lock-jaw), malignant edema, cholera, influenza, plague.

The necessity for the use of animal experimentation in any one of these may and does arise in hospital laboratories, and in private practice, wherever the best methods of diagnosis are appreciated and applied.

The petitioners assert that nothing new has been brought forward by the remonstrants. Nothing new can be brought forward until something new is offered by the petitioners. Nevertheless the remonstrants do not feel that these hear-

ings will have been in vain if the petitioners will but follow the suggestions made by one of their own organs in England. Speaking of the evidence offered to the English Commission which resulted in the passage of the English Anti-vivisection Act (39 and 40 Vic. c. 77) Stephen Paget says ("Experiments upon Animals," New York, William Wood and Company, 1900, page 215):

> "Practically, physiology alone came before the Commissioners, and such experiments in physiology as are now, the youngest of them, a quarter of a century old. Even the *Zoöphilist* advises its lecturers to cease from profaning these venerable relics of 1875. An old lecture or address must, to a certain extent, be always a perfunctory performance. The Blue Book has been a valuable mine for our speakers, but it is getting exhausted now. Sir William Ferguson was, no doubt, a great authority on our side, but he carries no weight with our present-day medical students. The recital of the horrors of Magendie's, Mantegazza's, and Schiff's laboratories have little or no good effect on English audiences; they are set aside as foreign and out of date. How often have we heard of the horrible experiments of Dr. Brachet! . . . But Dr. Brachet was born in 1789 and died in 1858, and in France, too." ("Zoöphilist," February 1, 1899.)

The rebuttal testimony offered consisted in the nearly, if not quite, complete reading of Dr. Bigelow's two articles on vivisection, published last year, and the animus inspiring it was plainly evident. We gave reference to volume and page, and brought the quotation forward to show what is perfectly evident to any one who reads the type, that by *vivisection* Dr. Bigelow had in mind painful, cruel, unanesthetized experiments upon living animals (such as occurred at Alfort in his student days, in and about 1841),

but that so far as painless, anesthetized experiments are concerned he stood precisely where we do, as stated in his own words, that they are "unobjectionable."

No one has made an attack upon Dr. Bigelow's character as a man or upon his eminence as a surgeon; it is a fair example of false inference to suggest that such has been the case.

It is perfectly possible to have, as we have in this instance, the highest regard and admiration for a man's power and ability, but at the same time to be fully alive to the possible existence of certain limitations. Such limitations, of one sort or another, have existed in every great man of whom history gives us cognizance — but one. Fighting for Dr. Bigelow's reputation is an entirely useless and unnecessary performance; we grant and agree to its deservedly widespread influence without the slightest hesitation.

If this bill be passed it may very seriously interfere with the work carried on under the support of such a fund as that concerned in the investigations on cancer now going on, and of which the report I hold in my hand is the first fruit. (Report submitted.) This report begins: "Through the public-spirited and far-sighted generosity of the late Caroline Brewer Croft, the Surgical Department of the Harvard Medical School has been enabled to undertake a systematic investigation into the origin of cancer."

The experiments under way were first begun a little over a year ago, and will be prosecuted until a successful ending is reached; when that may be no man can tell. But, in the meantime, inoculation experiments, not bacteriological in their nature, must be constantly carried on, and their results must be watched for long periods of time. Some of these may be done under anesthesia — of course if necessary they will be so carried out, but the killing of the animal as it comes out of the anesthetic must render

the performance of any operative procedure ridiculous under these circumstances.

This fund is, we believe, the largest yet given in any part of the world for the solution of a single problem in medicine, and it is perfectly certain that this lady, of a family whose benefactions to this community were already large, knew what such a gift involved and felt justified in her action by the misery and suffering that she has attempted to conquer.

In laying out the work, too, some of it has been — and some will have to be — intrusted to non-graduates in medicine, but at the same time to gentlemen competent to carry out the special line of research put before them.

CLOSING

Much has been said by the petitioners of the existence of evidence that they could not obtain — or at least bring before this committee — because it was in the hands of students who were afraid of their instructors. Gentlemen of the committee, here is a class-list of the students of the second year at the Harvard Medical School. It is at your service; and we say to you that if you wish to see for yourselves whether any such evidence as the petitioners declare does actually exist, send privately for any or all of these gentlemen and hear what they have to say. We shall be content to rest upon their judgment.

And now, gentlemen, we leave the decision of this matter in your hands.

These presidents of great educational institutions; these representatives of the clergy, teachers of various branches of biological science, surgeons and practitioners of different beliefs; these mental, moral degenerates; these human or humane defectives — whatever the epithet actually used was — rest their case in your hands.

NOTE. — The committee reported, *unanimously*, "Leave to withdraw," and this was after having made a prolonged tour of inspection of various laboratories in different parts of the Commonwealth. The House accepted the report without a division.

Date Due

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